SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1889, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXI.—No. 26. ESTABLISHED 1845. NEW YORK, DECEMBER 28, 1889. $3.00 A YEAR. WEEKLY.

1. Transmitting mechanism. 2. Perforator. 3. Punching attachment to type-writing machine. 4. Printed message. 5. Code and perforated strip. 6. Receiving a message. 7. Receiver, plan view. 8. Side view of receiver.

VISUAL SYNCHRONISM IN RAPID TELEGRAPHY.—[See page 405.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.....$3 00
One copy, six months, for the U. S. or Canada..... 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit $1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of seven dollars.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, DECEMBER 28, 1889.

Contents.

(Illustrated articles are marked with an asterisk.)

Accidents from electricity..... 405
Apparatus, air cooling*..... 402
Appliances, railway..... 405
Armor plate, war ships*.....404, 406
Business and personal..... 408
Carrier, paper, automatic*..... 402
Clutch, friction, Dunton's*..... 403
Combustion, spon., cotton bales. 404
Crane, traveling, Trabia*..... 405
Cut-off, rain water*..... 402
Electricity, accidents from..... 405
Epidemic, influenza..... 401
Fish, poison, Indian Ocean*..... 406
Gun, 110-ton, bending..... 404
Influenza, epidemic..... 401
Institute, Pratt..... 401
Inventions, engineering..... 408
Inventions, index of..... 409
Inventions, mechanical..... 408
Inventions, miscellaneous..... 409
Language instruction by phonograph..... 400
Moon, temp., in sunshine..... 405
Movements, rapidity of..... 407
Needham, Elias Parkman*..... 401
Nitrate of soda, Chilean*..... 407
Notes..... 401
Notes and queries..... 408
Obelisk, Central Park..... 401
Paintings, water color, fading.... 401
Powder, smokeless..... 400
Rifle, magazine, Russian..... 401
Sci. Am. pubs., rates..... 401
Sphinx, mountain..... 405
Steamer, thirty-five knot..... 401
Signal, railway, electric*..... 402
Synchronism, visual in teleg.*206, 406
Teeth, care of..... 403
Telegr., rapid, new system*....399, 405
Tie, rail, Jones*..... 402
Uranium in Cornwall..... 401
Water supply, Albany..... 400
Waves, sea, height of..... 401
Wax figures, how made..... 408

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 730.

For the Week Ending December 28, 1889.

Price 10 cents. For sale by all newsdealers.

PAGE

I. BOTANY.—Wood Lilies.—An interesting genus of North American plants, with one of its species particularly considered and illustrated.—1 illustration..... 11655

II. CHEMISTRY.—Estimation of Silica.—By GEORGE CRAIG.—A new method of determining silica by expelling it from its compounds by the action of hydrofluoric acid.—A very ingenious contribution to analytical works..... 11656
Note on Horse Fat and its Chemical Changes..... 11660

III. CIVIL ENGINEERING.—Douglas Head Suspension Bridge and Tower.—A new suspension bridge, of very striking appearance, proposed to be constructed on the Isle of Man, to do away with the necessities of ferries or of a long day tour, with a view of the extensive harbor works at that point.—1 illustration..... 11655
English Engineering.—The progressiveness of English engineers, as helped by the civic authorities..... 11658a
Highway Improvements.—A very interesting and striking paper, by Col. ALBERT A. POPE, the well known bicycle manufacturer, read before the Carriage Builders' National Association in their October meeting, being an eloquent plea for the necessity of better national and local roads..... 11657
The Channel Bridge—Preliminary Designs by Messrs. Schneider & Co.—The continuation of this elaborate article, treating of the peculiar features of construction introduced by the circumstances of the case, involving very interesting calculations on the wave motion to which the floats will be subjected..... 11656

IV. IRRIGATION.—Arid Lands of the United States.—The points made in an address, by Major JOHN W. POWELL, upon the problem of irrigation now before the people of the United States, with proposed method of governmental dealing with the subject..... 11654

V. MATHEMATICS AND SURVEYING.—Instruments for Drawing Curves.—By Prof. C. W. MACCORD.—An examination of the point on a curve termed the witch of Agnesi.—A curious example of curved drawing, with the instrument illustrated.—3 illustrations.. 11659
The Heliograph and Heliographic Signaling.—Heliographic surveying fully described, with illustrations of the instruments employed by the United States Signal Service.—5 illustrations..... 11660

VI. MISCELLANEOUS.—About Building Associations.—The much vexed subject of loan and building associations investigated, and a common sense view taken of the scheme..... 11665
Elias Parkman Needham.—Biographical sketch of the inventor of the parlor organ..... 11664
The Nitrate Works of Chile.—An interesting review of the extraction of Chile saltpeter, with a view of the fields where it is found and the process of extraction.—1 illustration..... 11660

VII. NAVAL ENGINEERING.—New Torpedo Boat for India.—A new torpedo boat of first class size, recently built for the Indian government, her dimensions, etc.—1 illustration..... 11658

VIII. PHOTOGRAPHY.—A New Magnesium Flash Lamp.—A very ingenious lamp, utilizing centrifugal force for projecting magnesium powder into a flame.—1 illustration..... 11662
Photo-Etching Method for Making Intaglio Plates.—Photo reproduction by recent processes described, with full details..... 11662

IX. PHYSICS.—A Trick Based upon the Principle of Inertia.—A very ingenious experiment in physics without apparatus.—1 illustration..... 11661
The Hydraulic Top.—A very ingenious physical toy.—1 illustration..... 11663

X. PHYSIOLOGY.—An Experiment in Color Blindness.—By JOHN SPILLER.—A very interesting paper on this much discussed problem, showing how santonine taken internally can affect the color sense..... 11665

XI. TECHNOLOGY.—Aero-Condenser for Drying Paper.—A plant for use in printing offices, for drying sheets of books.—1 illustration..... 11659
Historical Notes upon Explosives and Blasting.—By OSCAR GUTTMANN.—A very curious and deep investigation of the history of gunpowder, giving early anagrams in use by the alchemists..... 11661

THE ELECTRIC LIGHT TROUBLES IN NEW YORK.

The business of renting arc lights in New York city, save in isolated plants, has been almost wholly given up for the present; the companies discharging the men connected with their distributing service and preparing to devote themselves to making and selling plant.

The indiscriminate cutting of arc light wires has destroyed many thousands of dollars worth of property and rendered still more costly plant and construction comparatively valueless, and though it has long been clear that energetic measures were required on the part of the authorities, because of the danger to life as well as property made imminent by the constant appearance of vagrant currents of high tensions along low tension and often bare wires, it is to be regretted that what in all probability were the chief aggressors, to wit, the telegraph companies, including burglar, time, messenger, and similar services, have been left undisturbed.

Looking back upon the immediate causes of that public inquietude which led up to the adoption of the present measures, we shall find that, save where the victim's foolhardiness brought about his fate, the arc light system was only indirectly the cause of the accidents. It is an undisputed fact that the telegraph companies do not remove their dead wires, probably because of the expense and trouble. There are hundreds, doubtless thousands, of these, and, as every observer is aware, these are constantly parting. You can look out of the back window of almost any house and discover broken wires of one kind or another swaying to and fro, and such a sight is not by any means infrequent in the streets, especially in the side streets. Now, a dead wire, if broken and yet not hanging down far enough to interfere with the roadway or sidewalk, may remain for an indefinite period, swaying about. Its condition will not be noticed at the central office, because it is not in use.

Such wires, there is reason to believe, have been circuiting the arc currents, swaying hither and thither, and charging now this wire, now that, with the terrible intensity. The best part of the evidence yet adduced points that way. The experience with arc light currents in other cities where the telegraph lines are kept under careful inspection, and no such casualties have come, helps to the conclusion.

Besides this the light companies have had to contend against the constant interference of a board of electrical control, which, in the language of the Grand Jury, "is incompetent." Inspectors, for the most part incompetent, as might be expected of appointees of a political board, were found to be slighting their duties, the circuits were not "tested every hour," as the law provides, and even if they had been it would not have been sufficient under the circumstances, because a "ground" might take place a few moments after inspection.

POSITION OF THE PLANETS FOR JANUARY.

MERCURY

is evening star until the 30th, and after that time becomes morning star. He reaches his greatest elongation eastward from the sun on the 13th, at 8 h. P. M., being 18° 51′ east. He is then, and for a few days before and after, in favorable position for observation with the naked eye. He sets on the 13th, an hour and three-quarters later than the sun, and may be found in the west, about 4° north of the sunset point, becoming visible about three-quarters of an hour after sunset. Mercury is in inferior conjunction with the sun on the 30th, at 0 h. 42 m. A. M., passing between the earth and sun, like the moon at new moon.

Mercury sets on the 1st at 5 h. 31 m. P. M. On the 31st he rises at 6 h. 34 m. A. M. His diameter on the 1st is 5″.6, and he is in the constellation Sagittarius.

SATURN

is morning star. He has advanced so far toward opposition that he is very favorably situated for observers during the whole month. Star gazers, who are familiar with the Sickle, will easily find the planet about 4° east of Regulus, the bright star in the handle, rising at 8 o'clock in the middle of the month.

Saturn rises on the 1st at 8 h. 52 m. P. M. On the 31st he rises at 6 h. 44 m. P. M. His diameter on the 1st is 18″.2, and he is in the constellation Leo.

JUPITER

is evening star until the 10th, and morning star for the rest of the month. He is in conjunction with the sun on the 10th, at 0 h. 47 m. A. M., and passes to the sun's western side, to take his place among the morning stars. He meets Venus as he makes his way westward from the sun. The two planets are in conjunction on the 19th, at 4 h. 20 m. A. M., Jupiter being 27′ north. They are, however, too near the sun to be visible, and at the time of conjunction are below the horizon.

Jupiter sets on the 1st at 5 h. 4 m. P. M. On the 31st, he rises at 6 h. 17 m. A. M. His diameter on the 1st is 30″.6, and he is in the constellation Sagittarius.

VENUS

is morning star. She is of little account during the month on account of her great distance from the earth and her near approach to the sun.

Venus rises on the 1st at 6 h. 38 m. A. M. On the 31st, she rises at 7 h. 3 m. A. M. Her diameter on the 1st is 10″.2, and she is in the constellation Sagittarius.

URANUS

is morning star. He is in quadrature with the sun on the 16th, at 2 h. P. M., and is then 90° west of the sun. Uranus rises on the 1st at 1 h. 21 m. A. M. On the 31st he rises at 11 h. 24 m. P. M. His diameter on the 1st is 3″.6, and he is in the constellation Virgo.

MARS

is morning star. He is near enough to the earth to be readily recognized, a red star east of Spica, rising about 1 o'clock on the middle of month.

Mars rises on the 1st at 1 h. 42 m. A. M. On the 31st, he rises at 1 h. 5 m. A. M. His diameter on the 1st is 6″., and he is in the constellation Virgo.

NEPTUNE

is evening star. He sets on the 1st at 4 h. 21 m. A. M. On the 31st he sets at 2 h. 21 m. A. M. His diameter on the 1st is 2″.6, and he is in the constellation Taurus.

Venus, Mercury, Jupiter, Mars, Uranus, and Saturn are morning stars at the close of the month. Neptune is evening star.

Smokeless Powder.

According to the reports of Lieut. Crozier, who has made special observations in Europe concerning the practical values of the smokeless powders, there are difficulties that interfere with their common adoption, namely: The irregularity of pressure, the quickness with which they deteriorate, and the intense heat, which burns the shell and affects the accuracy of fire.

France, Germany, and Switzerland have issued the new powder for general use, but the discovery is still in an experimental stage. Switzerland is the only country that has adopted and adhered to a definite standard of smokeless powder for any length of time. With the new Swiss Reubin-Schmidt regulation rifle the highest velocity obtained with a charge of the new standard powder adopted by this country was 1,970 feet per second, the bullet used weighing 216 grains and the powder charge thirty-one grains. The pressure, however, was dangerously great—37,000 pounds to the square inch being recorded.

Rather better results were obtained by the French with the new Lebel rifle, an initial velocity of 2,020 feet per second and 34,800 pounds pressure being recorded, the weight of the charge of smokeless powder being 43¼ grains and that of the bullet 262 grains. These are about the best results ever given with a small arm. The highest velocity with our Springfield rifle is 1,350 feet per second.

Language Instruction by Phonograph.

Edison's phonograph has scarcely, as yet, passed the period of "novelty and curiosity," but many practical applications of the instrument have already been suggested, and have in some cases been actually carried out. There is one application, however, that we have so far not heard mentioned, and that is the instruction in the pronunciation of foreign languages. It is impossible to learn to speak a foreign modern language by self-instruction, since the true pronunciation can only be acquired by personal intercourse with one who is a native or equal to one in linguistic perfection. In the future the publishers of manuals of instruction in foreign languages will find it, most likely, a paying undertaking to publish a phonographic key of the various exercises, thus enabling the learner to acquire the correct intonation and pronunciation by causing the phonograph to repeat the word or sentence until it has been perfectly imitated by himself. Perhaps this suggestion may be thought to be foreign to the purposes of a pharmaceutical journal. But our profession is so situated, in many parts of the country, that a knowledge of more than one language is almost a necessity. And while actual instruction by a competent teacher is certainly the best method, the substitution of the phonographic method appears to us to be the next best in choice. We can only throw out the suggestion here, and must leave the practical execution to those who control the phonograph.—*Amer. Druggist.*

The Albany Water Supply.

The determined and costly attempt which was made at Albany to obtain an adequate supply of water from driven wells appears to have failed. The contractors guaranteed a supply of 15,000,000 gallons a day, but as yet from 390 driven wells a supply of but about 6,000,000 gallons a day has been obtained. Professor Mason of the Rensselear Polytechnic Institute, of Troy, in speaking of the subject recently, stated that Albany needed a supply of 20,000,000 gallons of water daily, and at the rate at which the wells are now yielding, it would require about 1,200 wells to furnish this quantity. Professor Mason believes the Hudson River to be the only adequate source of supply upon which the city can depend, but says that the river water should be thoroughly purified, and favors the adoption of a complete modern filter plant for this purpose.—*Fire and Water.*

The Pratt Institute.

We have from time to time chronicled the progress of the Pratt Institute in Brooklyn, N. Y. Although this institution cannot boast of a long existence, this has certainly been more than compensated for by an unprecedented growth and development, and by the modern, and in some respects unique, plan upon which it is organized. The rapid growth of the institution is obviously due to two causes; first, the demand for just such a school, and, second, the munificence which keeps pace with that demand.

From a perusal of the first number of the very creditable journal, *The Pratt Institute Record*, we learn that during the year several new departments have been created, among which are wood carving, clay modeling, and vocal music. Many volumes have been added to the library, and the shelving capacity has been expanded accordingly. The technical museum has received many new and interesting additions during the year, and the already capacious buildings have been enlarged so as to add 20,000 square feet of floor space.

The founder, in his address to the teachers, scholars and friends of the Institute on founder's day (October 2), mentioned a new feature which is now associated with the institution, and is known as "The Pratt Institute Thrift Association." This association is designed to assist people in general, and young people in particular, in saving and wisely investing their earnings. This association is divided into two parts, one known as the investment branch, and the other as the loan branch. The investments are made by purchasing shares of the association. These may be paid for in instalments or regular payments. They bring a fair rate of interest, and afford the safest and best kind of investment for savings. For example: One dollar per month, with the interest and premium, will in ten years amount to $160.

The loan branch is organized with special reference to aiding in the purchase of dwelling houses by persons for their own occupation, and although the association does not purchase or build houses, its organization is something like that of existing building associations.

Mr. Charles Pratt and his associates have recently made a tour of Europe, visiting all of the principal cities and absorbing ideas which might prove in any way helpful, and while they found nothing exactly like the Pratt Institute, they could see no reason for making changes in the main features of its organization or management.

A Thirty-five Knot Steamer.

The *Engineering and Mining Journal* has seen the drawings for a new steamer intended to make the Atlantic voyage in 4½ days. She is to be 434 ft. long, 2,880 tons displacement, patterned after the French torpedo boats. The new ship is to be capable of making 35 knots an hour for 24 hours, and an average for the above voyage of 28 knots an hour.

We hope the Secretary of the Navy will inquire into this proposed boat, and if it promises to be practical, ask for authority to build one quickly. It would be a great satisfaction to the public if Congress would show spirit enough to sanction the building of even one vessel that could reach the top notch either in speed or fighting strength. So far all the additions to the navy have been ships that are lacking in these qualities as compared with the boats of some other nations.

Epidemic Influenza.

The epidemic of influenza which we have already referred to as occurring in Russia has spread into Finland and eastern Prussia, and is not unlikely to spread throughout Europe, and even reach this country. The disease travels rapidly, and has been known to make all Europe sneeze within six weeks, so that we may expect an arrival here before our winter months are over. It used to be thought that this epidemic moved in definite cycles of one hundred years. Although such an idea has long been abandoned, it is a curious fact that the influenza prevailed in America one hundred years ago, and Dr. John Warren, in a letter to Dr. Lettsom, says that "our beloved President Washington is but now recovering from a severe and dangerous attack of it."

In 1830 an epidemic started in China, it reached Russia in January, 1831, and by May it had spread to western Europe; but it only reached this country in January, 1832, and then prevailed but slightly.

Another and severe epidemic started in Russia in December, 1836; within a month it appeared in London, and rapidly spread over Europe. This time, again, America was not affected. An epidemic of considerable extent prevailed in the United States about ten years ago, and there have been various mild manifestations of the disease. On the whole, however, North America does not seem to be very favorable to the development of epidemic influenza in its worst forms, and it is unlikely that we shall have a severe visitation, if we have any at all.

The disease is not dangerous, except sometimes to children or the aged, while the former often show a decided exemption.

There is no doubt that this new epidemic will prove a boon to bacteriology, for Seifert's micrococcus has not quite satisfied pathologists, and we anxiously await the announcement of the discovery of the influenza bacillus, only regretting for the sake of American science that the miasm always begins in the East and travels West. The bacteriological laboratories of Europe will therefore have the first chance.

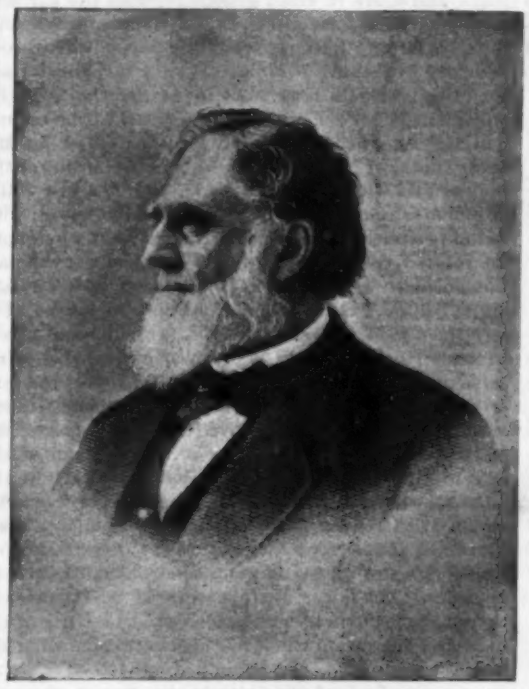
The disease is undoubtedly due to some micro-organism which floats in the air, and which infects the human system, but is generally killed in so doing. For influenza is but slightly if at all contagious.

We observe that some feeling of alarm prevails lest this epidemic be a precursor to cholera, as was the case in 1831 and 1847.

There have been, however, plenty of cholera epidemics without a preceding influenza, and a great many influenza epidemics without any associate cholera. The micro-organisms of the two diseases are as essentially different as are the diseases themselves. The cholera germ lives in water and soil, the influenza germ in the air. The relation between the two diseases has been, we believe, purely accidental.—*Medical Record.*

ELIAS PARKMAN NEEDHAM.

It is with much regret we record the death in this city, on the 28th ult., at the age of 77 years, of this excellent man and distinguished inventor, whose portrait we here present. He was the father of the modern parlor organ industry, and of its later branch, the automatic organ. An extended biographical sketch, containing many interesting facts, is given in the current number of our SUPPLEMENT, to which readers are referred.



ELIAS PARKMAN NEEDHAM.

Notes.

The International Maritime Conference has decided not to recommend the establishment of a permanent international marine tribunal to try questions of collisions between subjects of different nationalities, nor will it recommend the adoption of an international load line, like the English Plimsoll line, beyond which no ship may legally be loaded—a wise precaution, be it said, that has doubtless been the saving of many lives, and, generally speaking, has proved a check upon thoughtless and, perhaps, conscienceless owners and masters.

The Central Park obelisk has long been known to be suffering from the rigors of the climate. The disintegration of the surface has, indeed, increased since the application of a paraffine coating, a treatment that seems to have been recommended inadvisedly, well-informed persons calling it unscientific and inexcusable. Professor Eggleston, of Columbia College, an authority on such subjects, says that, while a coating of paraffine might benefit porous stones, it is exceedingly harmful to granite—the obelisk is of red sienite, a species of granite. It was the heating, he says, that did the mischief. It opened the cracks and emptied them of the fungus growths that had been accumulating there for ages. He declares that the heating given it and the rough handling of the workmen, who ruthlessly chipped this noble stone, prying off every piece that was fissured, effected more harm than its 2,000 and more years of exposure to nature's elements. Continuing, he says: "Most granite has three different planes of dilatation. Heat applied to the surface of this stone in our climate could not fail to set all these disastrously at work. Those who did the work confessed to have taken from the obelisk and carried off 800 pounds of its substance, and the probability is that the amount was twice as great. In its present condition and place I don't believe the monolith, as such, will last more than 60 or 70 years."

A dispatch from St. Petersburg says that a new rifle has been adopted for use in the Russian army. It can be used as a single firer or as a magazine gun, the soldier being required to carry two different kinds of cartridges. Russia has steadfastly refused to adopt a magazine gun heretofore on the ground of its well-known wastefulness, the soldier, as has been proved, being inclined to fire away without taking proper aim when he can do so without reloading, thus relying upon the number of shots rather than to their effectiveness, whereas, with only one shot to fire, he has been found to be more careful of his ammunition. Under all save extraordinary circumstances the new arm will be used as a single firer.

The big find of uranium in Cornwall, in England, and the prospects of a greatly reduced price for that formerly considered rare metal, is likely to lead to its employment as a substitute for gold in many ways. With copper and platinum, alloys are made with it that rival gold in beauty, indeed, where the latter is used with it, it will successfully resist the action of acid.

The height of sea waves has long been the subject of controversy. Eminent hydrographers have insisted that storm waves were usually not more than 10 feet high, and rarely over 20 when the conditions of the sea were most favorable for wave development. Many a traveler, reclining on a cabin transom, has looked up through the skylight to see the waves rearing their frothy crests, and wondered how even a 20 footer could show so high above a great ship's deck. Many a sailor dowsed by an up-driving wave while lying out on a topgallant yard has, doubtless, shaken his head incredulously when told that the highest waves were not above 20 feet, the rest being "heel" of ship and dip of yard. Now, however, comes expert testimony to prove that storm waves are often 40 feet and sometimes from 60 to 70 feet in height. In the recent British scientific expedition some instructive data were gathered by a sensitive aneroid barometer capable of recording its extreme rise and fall by an automatic register. "With a sea not subjected to an atmosphere of unusual violence, it indicated an elevation of 40 feet from the wave's base to crest." Admiral Fitzroy, after a long series of careful measurements from the main top of his ship, came to a similar conclusion.

A recent assertion that water color paintings are affected injuriously by constant proximity to electric lights, the more delicate pigments fading in consequence, does not seem to be borne out by the facts. As a disintegrating force, daylight is known to be far more powerful than electric light of equal intensity. The latter too, as is well known, is a less active agent than daylight to photographic paper.

This is the Last Number of this Year.

This issue closes another volume of this paper, and with it several thousand subscriptions will expire.

It being an inflexible rule of the publishers to stop sending their publications when the time is up for which subscriptions are prepaid, the present subscribers to the SCIENTIFIC AMERICAN or SCIENTIFIC AMERICAN SUPPLEMENT or the ARCHITECTS AND BUILDERS EDITION of the SCIENTIFIC AMERICAN whose subscriptions expire with the year will oblige us by remitting for a renewal without delay.

By heeding this request to renew immediately, it will save the removal of several thousands of names from our subscription books, and insure a continuance of the papers without interruption.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly), one year	$3.00
The Scientific American Supplement (weekly), one year	5.00
La America Cientifica (monthly), one year	3.00
Architects and Builders Edition of the Scientific American (monthly), one year	2.50

COMBINED RATES.

The Scientific American and Supplement	7.00
The Scientific American and Architects and Builders Edition	5.00
The Scientific American, Supplement, and Architects and Builders Edition	9.00

This includes postage, which we pay. Remit by postal or express money order or draft to order of

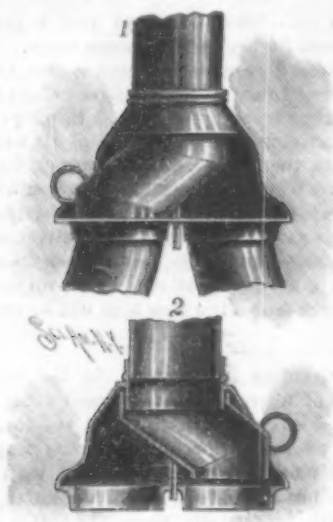
MUNN & Co., 361 Broadway, New York.

Tying up Branches.

Now is the time to tie together the limbs of those trees, both fruit and ornamental, that have made a long spreading growth, and whose limbs fork out. By tying all the limbs together about a foot up from where they leave the trunk, they are prevented from breaking or splitting down with the snows and ice storms of winter, as well as by strong winds. Use a stout, soft string, and it will not cut into or chafe the tree.

AN IMPROVED RAIN WATER CUT-OFF.

The accompanying illustration represents a simple device which may be readily adjusted to position and manipulated to direct the flow of water from the main leader to a supply or to a waste leader, Fig. 1 being a face view and Fig. 2 a sectional representation. This invention has been patented by Messrs. John M. Baird and Robert Sandstrom, of Topeka, Kansas. The cut-off body is formed with a flange adapted to receive the lower end of the main leader, this flange being carried downward to receive a flange formed at the upper end of a switching tube, the lower end of this tube also having a flange adapted to fit into flanges on the delivery and waste pipes. The switching tube is guided by a central stud or pin riding in bearings in the cut-off body.



BAIRD & SANDSTROM'S RAIN WATER CUT-OFF.

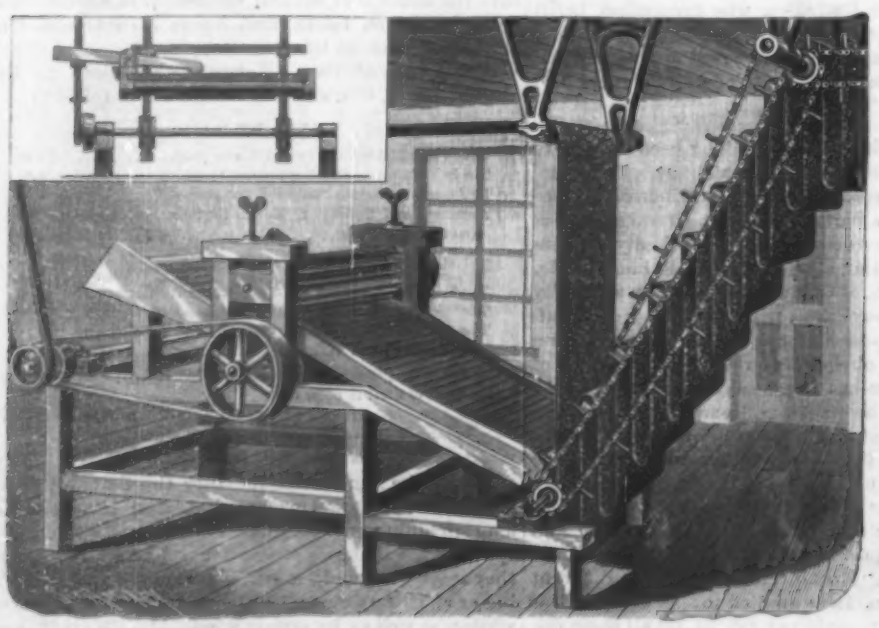
AN IMPROVED AIR COOLING APPARATUS.

The accompanying illustration represents an apparatus applicable to window or door openings for cooling the air supply, to promote comfort or contribute to the recovery of sick persons. It has been patented by Mr. Leon C. Fouquet, of Andale P. O., Kansas. Frames of light metal rods with cross bars and a filling of wire netting fabric are fastened to opposite sides of a window frame below the raised lower sash, and to these frames are fixed other cross bars from which wire ice baskets are suspended. To the inner side of each basket near its top is attached a rod from which is hung a coarsely woven flannel or woolen fabric. There is also a fabric-supporting rod above the upper ice basket, and the fabrics from all the rods are conducted outward and over deflecting rods, each fabric having at its lower edge a metal rod to hold the fabric down and prevent its being flapped about by the wind. The arrangement is such that the cold drip water from the ice baskets will trickle down over and through the fabrics into a drip tray held over the window sill, and having a laterally inclined bottom, with a faucet at one end for withdrawing the water. The fabrics are designed to spread over the full area of the window opening, thus cooling and tempering the air which enters the room. A water spray or sprinkler pipe is also arranged to be operated over each of the fabrics if desired, these spray pipes being connected with a common supply pipe communicating with a tank in which ice water is held, as shown in the illustration, or with any regular source of water supply, the flow being regulated according to the circumstances. The entire construction is designed to be light and cheap, and such as may be readily fitted to any sized window or door opening, and easily taken down and packed away in small space.

FOUQUET'S AIR COOLING APPARATUS FOR ROOMS.

AN AUTOMATIC PAPER CARRIER FOR DRYING ROOMS.

The endless web of paper coming from a press on which wall paper is printed, and from some forms of paper-making machines, is automatically received by carriers adapted to support the web in suspended loops, and move it along gradually, with the surfaces kept separated, for considerable distances, in spacious rooms or drying lofts, whereby the paper is dried preparatory to packing it for market. A machine for automatically feeding to such a carrier the laths on which the paper is looped is represented in the accompanying illustration, and has been patented by Mr. Isaac Dunn, of New Brunswick, N. J. In front of the hopper into which the laths are thrown is a bed roller or cylinder and an upper feed-regulating wheel with radial peripheral blades, so arranged that when both are rotated, the blades or wipers of the wheel will pass but one lath at a time, flatwise, to an inclined lath chute below. The feed-regulating wheel is journaled to be adjustable to accommodate laths of different thicknesses. The lath chute is grooved at its sides to receive opposite ends of the lath, and the lowermost lath is held in the chute by retaining plates extending across the ends of the grooved sides, the floor of the chute being notched to allow of the passage of the fingers or lugs of endless carrier chains, which take the laths one at a time from the chute. These carrier chains are fitted on lower sprocket wheels on a shaft journaled at the front lower part of the frame and on upper sprocket wheels on a shaft journaled in overhead bearings. The lower shaft is rotated to operate the carrier chains by a belt from a shaft at the rear of the machine, belts from the latter shaft also operating the bed roller and the feed-regulating wheel. To assure the positive feed of the lath to the carrier chains, a lever or knocker is fulcrumed on the chute frame to project its inner end above one of the lowermost laths in the chute, as shown in the small view. The outer end of the knocker is heavier than and adapted to raise its inner end, the knocker then resting on a stop fixed to the chute. The knocker is operated by fingers or lugs on an endless chain to which motion is communicated from the feeder shaft, each of the chain lugs, in passing, raising the outer end of the knocker, and causing its inner end to strike or knock the laths to assure their positive downward feed. The shafts which carry the upper sprocket wheels of the carrier chains also carry other sprocket wheels on which run endless carrier chains, with lugs or fingers adapted to take the laths on which the paper has been looped, and carry the laths and looped paper forward any required distance through a heated room or drying loft.

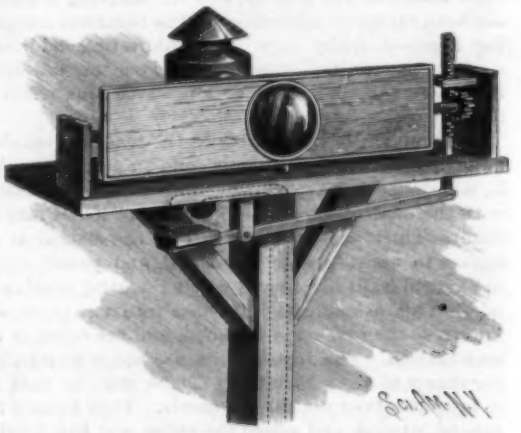


DUNN'S AUTOMATIC LATH FEEDER FOR PAPER CARRIERS.

AN Erie, Pa., note says: The South Erie Natural Gas Co. struck a large well right in the thickly built up portion of the city on Nov. 23. The gas blew everything out of the well and could not be controlled. A number of wells will be put down in the immediate vicinity. Hon. F. F. Adams has begun to extend his gas plant by putting down more wells. There are fully 100 wells in and around Erie.

AN IMPROVED ELECTRIC RAILWAY SIGNAL.

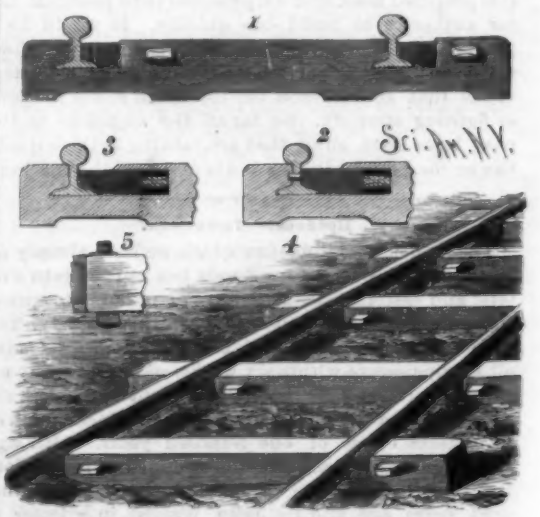
A simple form of signal board to be operated by an electro-magnet is shown herewith, and has been patented by Mr. Frederick W. Frith, of Bishop's College School, Lenoxville, Quebec, Canada. At the top of a suitable standard is a lantern-supporting shelf having at its ends vertical supports for the journals or pivots of a signal board, centrally in which is a lens or bull's eye. To the lower edge of this board is attached a weight to hold the board normally in a vertical position, and on one of the journals is keyed a pinion meshing with the teeth of a rack bar, pivotally connected at its lower end with a lever which carries at its free end an armature. This lever is fulcrumed on a hanger from the lower side of the lantern-supporting shelf, and the rack bar is guided in a keeper on the journal support. On the lower side of the shelf, above the armature on the lever, is held an electro-magnet, the conductors leading therefrom being arranged in connection with a battery and a push button, which may be located low down on the post, or at any convenient point, as in an outlookhouse. Then, by pressing the button, the armature is drawn against the magnet, throwing the lever and swinging the signal board to a horizontal position, and exposing the white light of the lantern. Upon the circuit being opened, the weight attached to the lower side of the board carries it to the vertical position with the colored lens in front of the lantern.



FRITH'S ELECTRIC RAILWAY SIGNAL.

AN IMPROVED RAILWAY RAIL TIE.

A railway rail tie designed to firmly hold the rails in position, and by means of which they can be readily locked to place, is illustrated herewith, and has been patented by Mr. Richard Jones, of Houston, Texas. Fig. 1 is a sectional view and Fig. 4 a perspective illustrating the application of this improvement, Figs. 2 and 3 being side views, the former showing a rail joint connection, while Fig. 5 illustrates the application of the key. At the proper distance apart in the top of the tie are transverse receeses to readily receive the rails, one side of each recess having a projection adapted to fit against one side of the rail web and the top of its base. On the opposite side of each of these recesses, centrally in the tie body, are apertures leading into each recess on the opposite side of the rail, where there is placed a retaining block of proper contour to fit against the rail web on its other side. These retaining blocks are each forced to place by means of a wedge-shaped key driven through a transverse slot in the rear of the apertures, each key being held to its place when in position by a cotter pin passed through an aperture in the small end of the key. In case the tie is to support a rail joint, the retaining blocks used in such cases are formed with a bolt-like projection adapted to pass through an aperture made therefor in the web of the rail, and into a like aperture in the opposite projection of the tie. To prevent lateral displacement of the



JONES' RAILWAY RAIL TIE.

track, transverse ribs or projections are formed on the bottoms of the ties. A single tie of this construction can be readily placed in a track already laid without removing the rails.

Care of the Teeth.

At the meeting in Berlin last spring of the German Association of American Dentists, the best means of preserving the teeth were discussed, and Dr. Richter, of Breslau, said: "We know that the whole method of correctly caring for the teeth can be expressed in two words—brush, soap. In these two things we have all that is needful for the preservation of the teeth. All the preparations not containing soap are not to be recommended, and if they contain soap all other ingredients are useless except for the purpose of making their taste agreeable. Among the soaps the white castile soap of the English market is especially to be recommended. A shower of tooth preparations has been thrown on the market, but very few of which are to be recommended. Testing the composition of them, we find that about 90 per cent are not only unsuitable for their purpose, but that the greater part are actually harmful. All the preparations containing salicylic acid are, as the investigations of Fernier have shown, destructive of the teeth. He who will unceasingly preach to his patients to brush their teeth carefully shortly before bedtime, as a cleansing material to use castile soap, as a mouth wash a solution of oil of peppermint in water, and to cleanse the spaces between the teeth by careful use of a silken thread, will help them in preserving their teeth, and will win the gratitude and good words of the public."

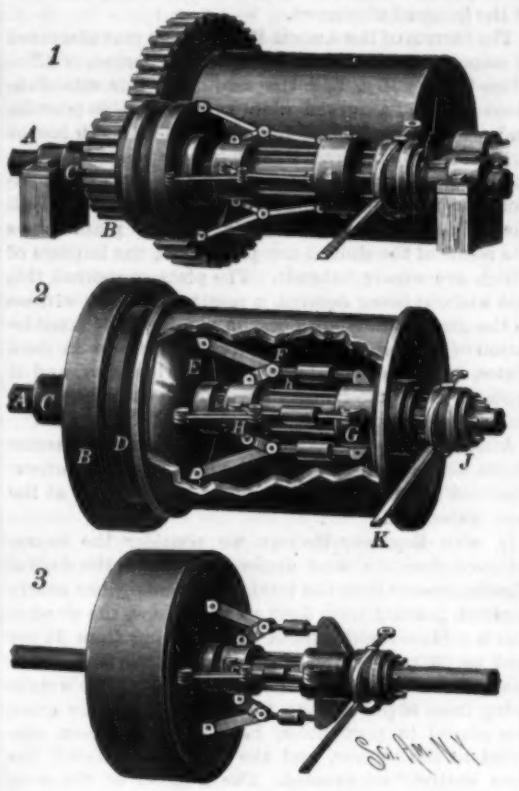
THE GREAT TRAVELING CRANE AT TRUBIA.

At Trubia the Spanish government has erected extensive works for the manufacture of the heaviest guns, and the establishment is now turning out armaments for the new steel cruiser Pelayo and other ships of war. Eleven inch and thirteen inch guns are the largest so far made.

Our engraving shows the new traveling crane lately erected at the Trubia works for handling these great guns and loading them upon the cars prior to removal to the coast. A beam of great strength is supported by its two ends upon a pair of hydraulic posts, each carried on a truck moved by an engine. Each truck forms, in fact, an independent locomotive. Suitable lifting gear and slings are arranged upon the beam, the gearing being worked from the ends of the beams. By means of this apparatus the heaviest guns may be quickly picked up, moved to the desired point, and the load deposited with the utmost precision. Our engraving is from *La Ilustracion Española.*

AN IMPROVED FRICTION CLUTCH.

The accompanying illustration represents a friction clutch especially adapted for hoisting machinery, in which a powerful friction and large bearing surface are required, and also designed for use on pulleys and



DENTON'S FRICTION CLUTCH.

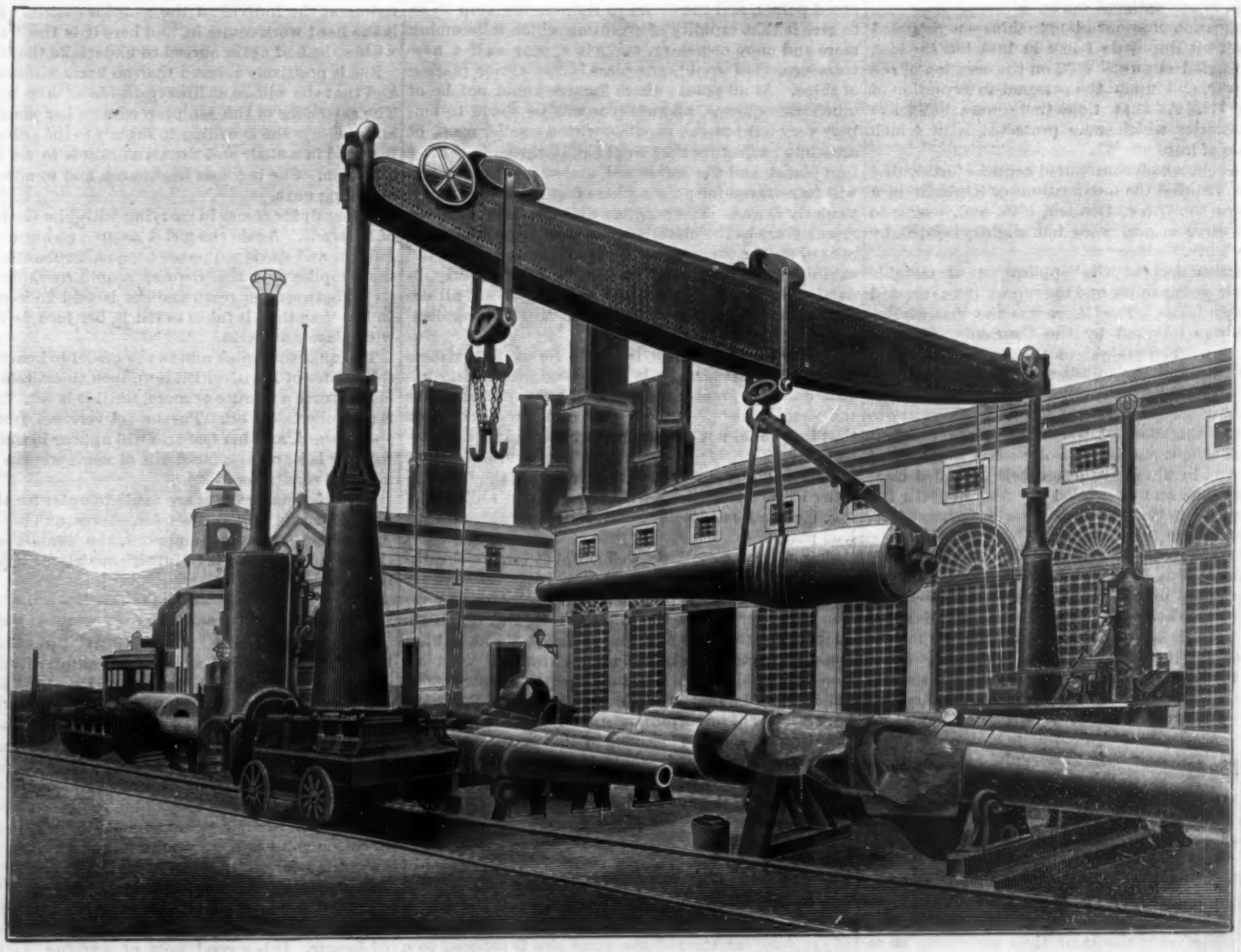
shafting. It has been patented by Mr. Daniel T. Denton, of Tower, Minn. Fig. 1 shows the clutch as applied on the outside of the hoisting drum, Fig. 2 illustrating its application within the drum, and Fig. 3 its use on a pulley and shafting. On the driving shaft, A, as shown in Fig. 1, is a loose pinion, B, meshing into a gear wheel on the drum of the hoisting machine, the outer face of the pinion resting against a collar, C, fixed on the shaft, while on its inner face is formed a friction flange, adapted to be engaged by a friction clutch wheel mounted to slide on and turn with the driving shaft. As represented in Fig 2, where the clutch is shown applied within the drum, the pinion and gear are dispensed with, the drum itself forming a loose pulley, B, on the driving shaft, where D is the friction flange engaging the friction clutch wheel, E, which slides on a key secured to the driving shaft. The clutch wheel, E, is pivotally connected by toggle links, F, with a collar, G, keyed on the main shaft, the pivot points of the links being pivotally connected with a collar, H, also turning with and sliding on the shaft. To the collar, H, are secured rods, *h*, extending parallel with the driving shaft through apertures in the fixed collar, G, the outer ends of these rods being secured to a shifting collar, J, sliding on the key on the driving shaft, this collar being shifted forward and backward, to engage or disengage the clutch, by the lever, K. By pushing the lever to bring the toggle links into a straight line, the clutch wheel, E, is thrown into frictional contact with the flange, D, of the hoisting drum. Fig. 3 illustrates the similar application of the clutch to a loose pulley on a driving shaft.

Accidents from Electricity.

Two more instances of the omnipresent danger due to the present systems of electrical distribution have been afforded during the last few days in this city. On the night of November 30, two clerks were engaged in carrying a metal frame showcase from the sidewalk into a store on Eighth Avenue. One of them stepped upon an iron grating, and as he did so the metal frame of the showcase came in contact with an arc lamp hanging over their heads. Suddenly the unfortunate man dropped his end and fell insensible. He never recovered from the shock. A new name is to be added to the long list of the killed.

On the night of December 3, the passengers in a Third Avenue Elevated Railroad train were startled by hearing a noise like hail emanating from the roof of the car. It proved to be due to electricity. The car had come in contact with a low hanging wire, and had probably drawn it along until it crossed a live wire. It is said that two of the passengers in the car received shocks.

The problem of safe distribution of electric energy seems to be a difficult one. Even when the wires are underground they can shock pedestrians, and many instances are on record of men or horses being shocked from subterranean lines. Moreover, under the present system of conduits as established in New York, electric subway gas explosions are added to the list of accidents. But a few days ago an electric conduit in Minetta Street exploded, blowing out manhole covers and involving great possibilities of damage to life and property.



THE GREAT TRAVELING CRANE AT TRUBIA.

ARMOR PLATE FOR WAR SHIPS.

The numerous visitors to the exposition remarked with great interest, in the pavilion of the Minister of War, the huge armor plates exhibited as specimens of the armoring now applied in our navy.

The crowd stopped before these heavy and imposing masses, and were filled with astonishment on thinking of the power of the armorclads that are capable of floating with such a sheathing, and with more astonishment still, perhaps, on thinking of the power of the machinery that metallurgy now has at its disposal for obtaining such plates. The preparation of the military products serving for attack and defense was, in fact, the starting point of most of the progress realized for the last thirty years by metallurgy, and of the incessant development of its machine tools.

In this continuous contest that has been going on between the attack and the defense, between the cannon and the armor plate, it is from metallurgy that each has demanded arms. The artillerist has endeavored to obtain a lighter and, at the same time, a more resistant gun, capable of giving, through the elongation of the chamber, a greater initial velocity to the projectile; and for the projectile itself, he has desired a harder and harder metal, capable, without breakage, of supporting a continually increasing energy of impact against armor plates, which themselves are becoming more and more resistant.

The engineer of naval constructions, on his part, has endeavored to give his armor plates all the resistance possible, by increasing the thickness up to extreme limits, as well as by the best distribution of the metal, the most scientific study of forms, and especially the use of harder and harder metal.

Hence result the ever new exigences in the manufacture of guns, projectiles, and armor, that have necessitated the use of larger and larger ingots, with maneuvering apparatus and rough forging and finishing tools, and the adoption of steels whose physical qualities of hardness, toughness, and homogeneousness have always gone on increasing.

It is thus that metallurgy has been led to develop its tool equipment continually from all points of view, until it now works masses weighing from 90,000 to 100,000 pounds, and which forgemen of former times would never have thought of handling. It has scientifically studied the metal to be elaborated, and has succeeded thereby in treating it under minutely determined physical and chemical conditions, thus making of the forge as it were a laboratory on a large scale.

Our national metallurgy can claim its part in the great progress realized by our armament, and such progress, which will allow us to await the contests of the future with more security, has been recognized by foreigners themselves, who have ordered numerous products from our national works.

The application of armor plate to ships was proposed by the eminent Dupuy de Lome in 1845, but the idea was not carried out until 1854, on the occasion of the Crimean war, and upon the personal intervention of Napoleon III. At that time there were built five floating batteries, which were protected with 4 inch armor plate of iron.

These vessels, which constituted genuine forts rather than ships, reduced the fortifications of Kinburn in a few hours on the 17th of October, 1855, and, owing to their protective armor, were but slightly injured by the enemy's fire.

This success decided the application of metallic armor to sea-going ships, and the type of it was created by Dupuy de Lome. The Gloire was the first armorclad, and was followed by the Couronne, Flandre, Magenta, etc. The weight of the cuirass was then about 900 tons, and the number of men in the crew was from 500 to 600. Later on, about 1865, in view of the progress of rifled artillery, it was found necessary to increase the thickness of the armor plate to eight inches, and then came the type of vessels represented by the Ocean, in which the armor belt extended clear around the ship, and descended 6½ feet beneath the water, and rose in the center to form an armored redoubt carring four 10¼ inch guns.

At the four angles of this redoubt there were as many turrets armed with 9-inch guns. Analogous arrangements are found on the Redoutable—one of the first ships constructed of iron. The substitution of metal for wood permits of reducing the weight of the hull and increasing the weight of the armor, the latter reaching 12½ inches at the load water line in the vessel under consideration. On this ship, the first one provided with armored deck, there is an octagonal redoubt protected with 11¾-inch plate and armed with four 10½-inch guns. The armor plate employed is iron and is 2¾ inches in thickness.

In the Amiral Duperre and the Amiral Baudin, the cuirass reaches its maximum thickness, so to speak, being 21½ inches at the center of the load water line and 15¾ inches beneath. The huge mass thus exceeds the weight of 8,360,000 pounds, and the elements of which it consists weigh no less than from 35 to 40 tons each.

Armor plate has at the same time undergone an essential transformation that has been necessitated by the progress of artillery. It became necessary to look for a metal harder than iron—which is too easily penetrated; and so steel has finally been applied to the manufacture. At the same time a mixed metal has been created, consisting of an iron plate covered with a layer of hard steel, designed to break the projectiles at the moment of impact.

The turrets of the Amiral Baudin were manufactured of mixed metal by the Compagnie des Forges, of Chatillon-Commentry, and the exhibit of this establishment included a curved plate weighing 70,000 pounds, and which was 13 feet long, 6½ wide, and 20 inches thick. This plate is represented lying upon the ground in Fig. 2, page 406. As for iron plates, we may mention the large one which was the admiration of all the visitors, and is shown in Fig. 1. This plate shows the result of the shot of five projectiles, the impacts of which are nearly tangent. The plate supported this test without being fissured, a result that bears witness to the great malleability of the metal. This consideration of malleability is of capital importance in deck plates, in which rents might lead to leakages, and it explains the preference shown up to the present for welded iron for the protection of decks.

After the Amiral Baudin, the thickness of armor plates tends to decrease, and upon the four armorclads not yet finished it is reduced to 18 inches at the load water line.

If, with Engineer Hauser, we consider the course followed since the first armorclads up to the Amiral Baudin, we see that the total displacement has nearly doubled, passing from 5,800 to 11,400 tons, the wooden hull is replaced with one of iron, passing from 14 per cent to 35 per cent of displacement, and the armor passes from 4½ inches to 21¼ inches, with a weight going from 16 per cent up to 35 per cent. The guns, first placed in port holes, have gradually been relegated to the turrets, and the armored redoubt has been entirely suppressed. The number of the crew has not been modified much, for although that of the Marengo reaches 730, we find that of the Amiral Baudin to be but 500—a number less than that of the Flandre.

In the artillery properly so called, the calibers of the guns, and especially the lengths of the chambers, are continually increasing in order to attain greater and greater velocities with slow-burning powders; and 12½ and 13 inch guns are now being constructed that have a chamber length of as many as forty calibers. The Societe des Forges et Chantiers de la Mediterranee exhibited a specimen of such a gun designed for the turret of a Japanese armorclad, and with which may be obtained a velocity of 229,600 feet at the muzzle.

The invention of new explosives, making it necessary to protect the live works as well as the men at all exposed points, and the desire to lighten the ship so as to give it that rapidity of evolution which is becoming more and more necessary, make it appear as if a new transformation would take place in the armor plating of ships. At all points where fissures would not be of much consequence, an endeavor will be made to employ very hard metal, capable, with a smaller mass, of arresting projectiles that would pass through thicker iron plates, and the softer and more malleable metals will be reserved for points where fissures are to be particularly feared. The progress that has been made in recent years in the metallurgy of steel fortunately permits of such a programme being carried out, and the exhibit of the Company of Chatillon-Commentry, in particular, included complete series of plates of all degrees of hardness, perfectly adapted to every application that may be had in view.

The large plate shown in Fig. 2 forms the extreme series of the soft metal. It has a resistance of penetration one-fifth greater than that of welded iron, and at the same time presents a perfect homogeneousness that iron could not possess, and at least an equal malleability.

This may be seen by an examination of the indentations made in the tests with normal and oblique firing, for such results have never been obtained with iron plates.

This metal is peculiarly well adapted for the sheathing of deck plates. Afterward came plates of medium hard metal, having an excess of resistance to perforation a quarter greater than that of iron, and which are adapted for the belts of ships. Finally, we have hard metal plates that are better adapted for the construction of light shields of all kinds, and the resistance of which exceeds that of iron by one-third. We have here a series of important results obtained by the application of scientific methods in the working of steel, and we have thought it would be of interest to make them known, by reason of the services that our navy can hope from them.—*La Nature.*

New Photographic Lens.

M. Ch. V. Zenger employs two correction lenses of magnesium glass of the same focal length, one concave and the other convex. The focal length of the system is the same as that of the spherical mirror. The time of exposure for stars of the same size is reduced to a third or a quarter.—*Comptes Rendus.*

Bending the 110 Ton Gun.

It is stated that a 110 ton Armstrong gun has bent during test. No details have as yet reached us. Mr. James A. Longridge, C.E., and General Maitland give the following particulars with regard to the life of heavy guns:

It appears that the 110 ton gun—16¼ inches—will fire 95 ordinary rounds; after this the gun is unfit for service. The 67 ton—13½ inches—will fire 127 rounds, and the 45 ton gun—12 inches—will fire 150 rounds, after which these guns are unfit for service. The cost of the 110 ton gun is £16,500, the 67 ton gun £10,900, and the 45 ton gun £6,300. Thus the cost of the 110 ton gun alone will be for each discharge of shot £174, for the 67 ton gun £86, and for the 45 ton gun £43. The cost of a single round for material alone for the 110 ton gun is as follows:

	£	s.	d.
900 lb. of powder	70	0	0
1,800 lb. projectile	90	0	0
Silk for cartridge	3	0	0
Deterioration of gun (life of gun taken at 95 rounds)	174	0	0
Total net cost of each round	327	0	0
For the 67 ton gun:			
520 lb. of powder	40	10	0
1,250 lb. projectile	55	10	0
Silk for cartridge	2	0	0
Deterioration of gun (life of gun taken at 127 rounds)	86	0	0
Total net cost of each round	184	0	0
For the 45 ton gun:			
295 lb. of powder	23	0	0
714 lb. projectile	31	0	0
Silk for cartridge	1	0	0
Deterioration of gun (life of gun taken at 150 rounds)	43	0	0
Total net cost of each round	98	0	0

The 67 ton gun would penetrate 27 inches of wrought iron at 1,000 yards, and the 45 ton gun would penetrate 20 inches of wrought iron at the same distance.—*The Engineer.*

How Wax Figures of Celebrities are Produced.

The following is an abstract from an interview between the artist and a reporter for the New York *Sun:*

I can always find young women willing to pose, and, nine times out of ten, obtain a subject whose face so closely resembles the photo in question as to answer all purposes.

The "model" visits the studio and poses as the sculptor desires. First, a cast of clay is made of such portion of her anatomy as is required. About this is constructed a plaster of Paris mould, into which is poured a preparation of wax known only to this sculptor. The figure formed in this way is remarkably lifelike, but by no means equal to the figures produced when a plaster cast is taken of the subject supposed to represent the individual the sculptor desires. Here it is the hard work comes in, and here it is the "model" wishes she had never agreed to undertake the task.

She is positively assured that no harm will befall her and that she will be at liberty inside of five minutes. The assertions of the sculptor restore her confidence, and she says she is willing to submit to the ordeal. She is seated in a chair and the artist retires to an adjoining room. She becomes frightened, and wonders what is coming next.

The sculptor comes in carrying with him the utensils of his trade. Again the girl is assured no harm will befall her, and she is requested to open her mouth. When she complies with this request, a quill toothpick is inserted between her teeth and she is told to keep still. In less time than it takes to tell it, her face is covered with plaster of Paris.

The quill toothpick allows the model to breathe, and the plaster of Paris, which is an inch thick, remains on her features a minute or more, until it is set. Then it is carefully taken off. The model receives from $1.50 and upward, and her features will appear in some shop window later on as a fac-simile of some woman with a national reputation.

These figures or busts are made to order for the purpose of supplying models for stores and museums. Aside from supplying museums, the hardest work in this unique business is to furnish models for hair-dressing establishments.

Spontaneous Combustion of Cotton Bales.

The Boston Manufacturers' Mutual Fire Insurance Company has issued a circular calling attention to the danger of spontaneous combustion of bales of cotton which have become impregnated with cotton seed oil. Two bales are cited which had absorbed two hundred and fifty-six and one hundred and seventy-five pounds respectively. Leakage from barrels contained in the same cargo might account for the occurrence. Such cotton is very liable to heat and to break out into active combustion. The more frequent fires in cotton ships and warehouses, it is thought, may be accounted for on this basis. It is suggested by the company named, whose circular is signed by Mr. Edward Atkinson, the eminent statistician, that cotton bales should be watched and inspected for this source of danger. It is a good note of warning, and should be given full attention by all interested.

A NEW SYSTEM OF RAPID TELEGRAPHY.

To those familiar with the history of telegraphy and other great inventions, it appears strange that the invention of Prof. Morse should have retained its identity through all these years of telegraphic development and improvement. The original code, and substantially the original instruments, have been and are used to a greater extent than any other.

The main improvements in telegraphy up to the present time have the Morse system as a basis, and consist principally in increasing the capacity of the telegraph lines by duplexing and quadruplexing, and by the system known as "Rapid Telegraphy," in which messages are transmitted by means of a perforated strip of paper, and received upon a strip of chemically prepared paper. In all these systems the Morse code is used, and as a consequence, the message requires translation into characters which are legible to the generality of people.

Other systems of telegraphy in which the messages are delivered in print are used to a limited extent. Among these are the "Phelps printer" and the type writer telegraph; but these, as compared with the other systems referred to, are slow, and are incapable of being duplexed or quadruplexed.

For years, inventors have known that great possibilities lay in a practicable means of synchronizing instruments at the end of a telegraph line, and many attempts have been made to secure a simultaneous duplication of mechanical motions at points distant from each other. This result has been accomplished by means of the pendulum, and by the phonic wheel of Lacour; but the speed attained by these means falls far short of the ability of the current to respond in the transmission of impulses or signals.

Our attention has recently been called to an entirely new method of obtaining perfect synchronism at a very high rate of speed. This method, together with a new telegraphic code and transmitting and receiving mechanism, are the invention of Mr. J. Harris Rogers, who has also added a simple and effective punching attachment to be applied to any type-writing machine, so that the messages may be written by a type writer and simultaneously cut in the transmitting strip, the whole being combined into a system which can be operated by any person of ordinary intelligence at a speed far greater than that attained by any other system of telegraphy.

This system is fully illustrated in our front page engraving and in the diagram, Fig. 9. Fig. 1 shows the transmitting portion of the apparatus in perspective; Fig. 2 shows the manner of using the detached punching machine; Fig. 3 represents an electrical punching machine connected with an ordinary type writer; Fig. 4 is a view of the printed strip delivered by the receiving machine; Fig. 5 represents the code and a portion of a perforated strip ready for transmitting a message; Fig. 6 shows the machine receiving the message; Fig. 7 is a plan view of the printing device; and Fig. 8 is a side elevation. This system has been tested between Washington and New York in the presence of many well-known experts. The machines demonstrating this method were examined by us at the offices of the Visual Synchronism Co., at 34 Broadway, N. Y. W. B. Hopkins, general manager.

As the synchronizing apparatus is the vital portion of the system, we will first describe how the instruments at opposite ends of a long line are made to revolve synchronously. At the ends of the line are arranged instruments which are precisely alike, therefore a description of one will answer for both. Upon a shaft, B, is mounted a heavy fly wheel, A, about fourteen inches in diameter, and upon the boss of this wheel is placed a collar insulated from the boss and connected with a wire arm, *a*, which extends into a recess in the rim of the wheel, A, to a point within striking distance of the metal of the rim. This wire is otherwise insulated so that when a secondary discharge is sent through it, a spark will appear in the recess of the wheel. The secondary circuit through which the spark current is sent is generated in the induction coil, H. One terminal of the induction coil is connected with an insulated ring on the boss of the wheel, A, by means of a brush, and this ring is in electrical connection with the ring which supports the wire, *a*. The other terminal of the induction coil is connected electrically with a brush which contacts with the shaft, B. One end of the primary wire of the induction coil is connected with the battery, I; the other end is connected to the back contact of the armature lever of the relay, J, and this armature lever is connected with the remaining pole of the battery, I. Whenever a current passes through the relay, J, the primary circuit of the induction coil, H, is broken, and the impulse set up in the secondary wire of the coil produces a spark in the recess of the wheel.

Now it is evident that if the wheel, A, at the distant station can be made to send an electrical impulse through the relay, J, once during each revolution, this will cause a spark to appear in the recess of the wheel, A, once during each revolution of the wheel at the distant station. If the spark in the recess of the wheel is produced at each time at the same point in the revolution of the wheel, it shows that the two wheels are synchronous; but if the spark appears at different points in the revolution of the wheel, it clearly shows that the wheels are not synchronous. If the spark appears to travel forward, the receiving wheel, A, is revolved slower than the distant wheel. If, on the contrary, it appears to travel backward, the speed of the receiving wheel is too high. The power is applied to the receiving wheel in such a manner as to produce an excess of speed, and the synchronizing is effected by applying either a mechanical brake or the finger or thumb to the periphery of the wheel until the speed of the receiving wheel is so reduced as to cause the spark to appear stationary. When this occurs, the instruments are in condition for transmitting or receiving messages.

Surrounding the shaft, B, there is a sun wheel, E, carrying on its periphery twelve commutator plates, numbered from one to twelve. The plate is connected through the multiple switch, N, and brush with the shaft, B, and the shaft, B, receives a current from the brush connected with one pole of the battery, L, the other pole of the battery being grounded, as shown.

Upon the boss of the wheel, A, is secured a metallic ring which is insulated from the boss, and has an angled arm, F, which reaches over the stationary sun wheel, E, and carries a brush which contacts with the commutator segments, 1, 2, 3, 4, 5, etc. A brush, *b*, touches the ring of the arm, F, and is connected with the line. It will be seen that whenever the brush carried by the arm, F, touches the commutator segment, 12, the circuit is completed over the line, and if this happens at both ends of the line simultaneously, both of the relays, J, will be worked, and the sparks will appear in the two wheels at the same time.

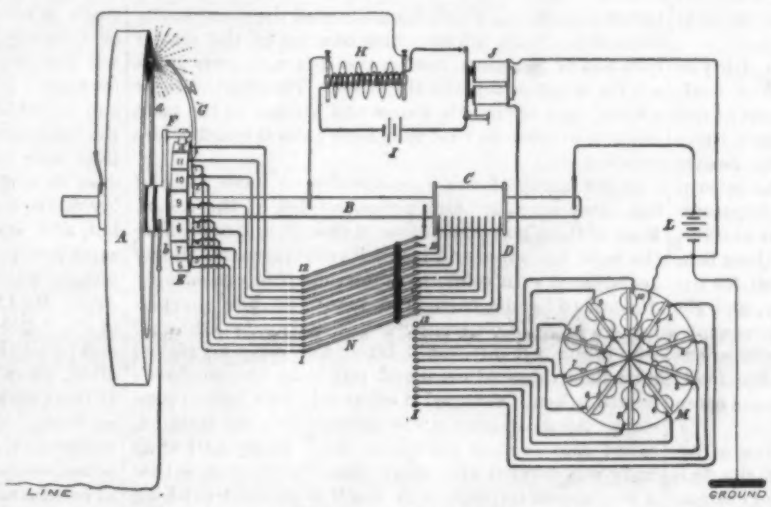


Fig. 9.—NEW SYSTEM OF RAPID TELEGRAPHY—DIAGRAM OF CIRCUITS.

The sun wheel, E, is movable around the shaft, B, and is provided with an arm, G, opposite the segment, 12, which is used to move the sun wheel whenever the spark appears stationary at a short distance from its normal position. By moving this arm the sun wheel, E, with its commutator segments is brought into proper relation to the wheel, A.

Upon the shaft, B, is mounted a metallic cylinder, C, over which the perforated transmitting strip is carried with an intermittent motion, being moved forward one step for each revolution of the shaft, B. Upon the cylinder, C, rests a series of contact springs, D, numbered from one to ten, and corresponding with the commutator segments having the same numbers. The springs, D, are brought into electrical communication with the commutator segments by the multiple switch, N, and the connected wires, as shown. When the perforated transmitting strip is passed over the cylinder, C, the springs, D, rest upon the paper, or upon the cylinder, C, through the perforations of the paper.

During each contact of the series of the springs, D, with the cylinder, C, a series of contacts will be made by the brush carried by the arm, F, with the commutator segments, and there will be a correspondence in the frequency of these contacts and the position of the springs, D, in contact with the cylinder, C, so that when this brush contacts with any segment of the commutator, the brush of the receiving instrument will contact with the same segment, and will therefore actuate a section of a segment of the receiving instrument which corresponds to the same section of the transmitting instrument.

It will therefore be seen that as long as the sparks in the wheel, A, remain in a fixed position, or so long as the arm, E, can be moved so as to bring it opposite the cavity as the spark is formed, there will be perfect synchronism, and messages may be transmitted with perfect accuracy and with a speed which produces ten or more impulses over the line for every revolution of the wheel.

The code of this system consists of ten marks, made in different positions and at different angles, the whole when combined forming a monogram like that shown in Fig. 4, and in this monogram are the elements of all of the letters of the alphabet. It is true that perfect Roman letters cannot be made from these elements, but an approximation to such letters can be formed, and the message is as legible as any printing. The marks of this monogram are produced by ten arms arranged radially, and carrying armatures which are operated by an equal number of electro-magnets. These electro-magnets are numbered from one to ten.

As shown in the diagram, the instrument is ready for the transmission of a message. By transferring the multiple switch, N, to the contacts, I, the series of magnets, M, of the receiver will be thrown into communication with the commutator segments, while the relation of the relay, J, to the system still remains the same. The apparatus is provided with a feed mechanism which carries a strip of paper under the printing arms, the feed being effected by a step by step motion, one step being produced by every revolution of the shaft, B.

Every turn of the wheel, A, produces a character or letter, and, as a consequence, when the wheel makes 1,000 revolutions per minute, 1,000 characters or about 200 words will be transmitted. If the speed is doubled, it goes without saying that the number of words will be increased in the same proportion. By the old systems of synchronizing, the greatest speed attained is 300 revolutions per minute. In the experiment of the Visual Synchronism Company above referred to, a speed of 2,500 revolutions per minute was reached.

The printing is done through the medium of an inking ribbon, so that the characters are perfect and durable, and the message is ready for delivery as soon as it leaves the machine. The strips are prepared for transmission by a small electric punching device used in connection with an ordinary type writer, so that while the message is written out upon the type writer, the paper strip is prepared for the transmission of the message.

A method of preparing strips which is somewhat more rapid than that of the type method is illustrated by Fig. 2, in which a ten-keyed perforator is used. With this machine the preparation of the message almost equals stenography in point of rapidity. It is thought by the promoters of this system that an active manipulator could transmit a speech directly by means of the ten-keyed punching machine without calling in the aid of stenography. A portion of the speech could be recorded on the strip, and the strip torn off and carried to the transmitting machine, and transmitted while another strip was in process of preparation.

It is obvious that the speed of the transmission of words could be greatly increased by adopting a stenographic code, but this would necessitate the translation of the message.

The transmission of secret messages by this system is a feature of great importance. It is plain that any person having a typewriting machine with a punching attachment, or a ten-keyed punching machine, can prepare messages apart from any connection with the telegraph office, and send such messages to the telegraph office for transmission. As a precaution, the type-written record will be retained by the sender of the message, for future comparison with the transmitted message, if this becomes necessary.

By a simple alteration of the punching mechanism, each patron of the telegraph can have a code of his own by which messages may be transmitted, which can be read only by the aid of a key furnished by the sender. The value of this feature will be appreciated in many lines of business where it is of importance to maintain secrecy.

It is obvious that all the indistinctness and uncertainty common to the use of chemical paper is avoided in this system. The ill effects of the static charge of the line are prevented by a duplication of the relay, which permits of maintaining a continuous current upon the line. A great advantage is gained in the pause of the contact of the transmitting contact springs, thereby giving ample time for the current to act to its fullest extent.

It is, perhaps, unnecessary for us to enlarge upon the advantages of this system, as they will be apparent to any one who will examine it after acquiring a moderate knowledge of other systems of rapid telegraphy.

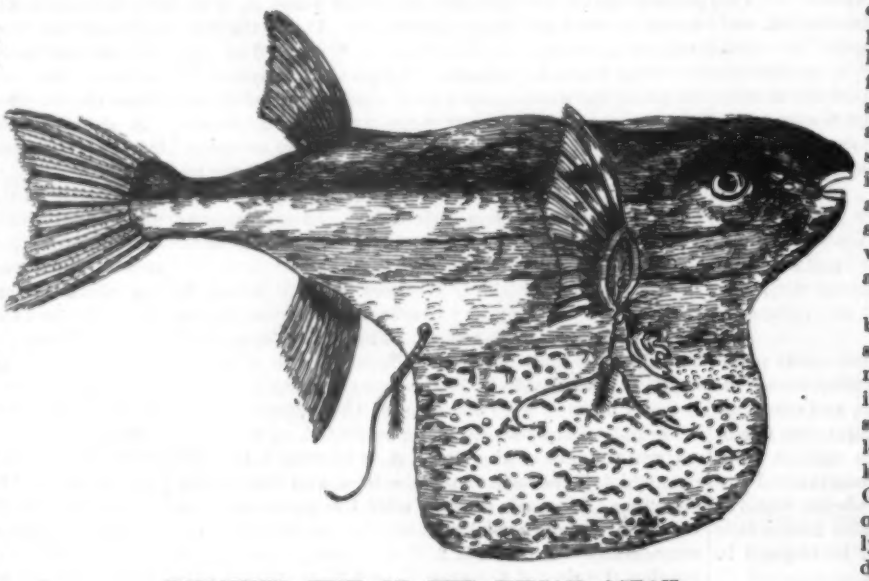
TEMPERATURE OF THE MOON IN SUNSHINE.—The most recent researches of Professor S. P. Langley indicate that the mean temperature of the sunlit lunar soil is probably not greater than zero Centigrade, or 32° Fah.

POISONOUS FISH OF THE INDIAN OCEAN.

BY NICOLAS PIKE.

All early voyagers to the Indian Ocean speak of the great beauty and variety of its fish. Commerson and Bougainville, in their voyage round the world in 1779, remained for a time at the Isle de France (now Mauritius) and collected over a hundred different species, of which nearly two-thirds were new to science, and of nearly all they made notes and sketches. After Commerson's death the collections were set to Buffon, but he neglected them, and later they fell into the hands of Lacepede, who described them very imperfectly from the dried specimens. Dumeril, long after, found part of the MSS. in a garret over the Museum of Paris and some sketches in Strassburg Library. They eventually found their way to Cuvier, who acknowledged their great use in preparing his "Natural History of Fish." Many distinguished men have collected fish, but few have written any account of them—past a few anatomical notes. Dr. Desjardins wrote considerably, but his MSS. have all been scattered; and M. Lienard not only wrote, but gave a valuable collection of fish to the Museum of Paris and Port Louis, Mauritius; but little is generally known of his writings.

During my residence at the latter place I had exceptional chances for collecting and studying these fish. I was fortunate enough to procure 500 species, now in the Museum of Comparative Zoology of Cambridge, Mass., where twenty seven were described as new species and one a new genus.



POISONOUS FISH OF THE INDIAN OCEAN.

No idea of their beauty can be formed from dried or alcoholic specimens; they must be seen when fresh from the bright waters of the ocean. Brilliant as are their colors, there is no place in the world where there are more that possess deleterious and even deadly qualities. So much is this the case that the government has seen fit to impose heavy fines and imprisonment on the fishermen who bring such fish to market. It was thus difficult to procure specimens of these fish, mostly unknown elsewhere; so I had to watch for the boats that came inshore outside of the city, and get them from the men, who saved them for me when caught in their seines or on their lines. Many of them are as dangerous to handle as they are poisonous for food; and others with terrible weapons in their fins are eaten when deprived of them.

Of the latter class are the *Lafs* I have written of before, but every spine is cut as soon as caught, the flesh being innocuous. The *Machaourau* (Arius) and *Cordonnier* (Teuthis) are very nice pan fish, but every fin must be cut off before they come to market. The magnificent yellow-tailed *Croissant*, glittering in scarlet, yellow and purple (a Serranus), grows very large, and is termed a *soulard*, or drunken fish, from its effects on its victim. They do not stop here, but the man grows delirious with sharp intestinal pains, and the whole system is deranged. I was astonished to see some fine ones landed, though not taken to market, and a fisherman told me that when well salted and prepared it can be eaten,

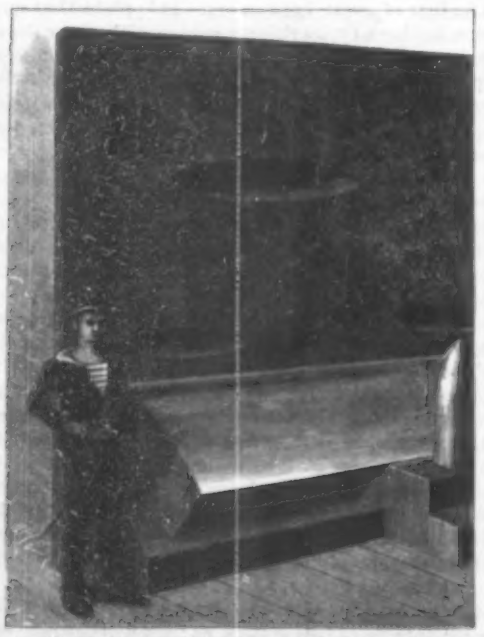


Fig. 2.—DECK PLATE OF THE SUCHET—PLATE OF THE FORMIDABLE.—[For description see page 404.]

but it would be dangerous for any but an expert to risk it. Strange to say, the white-tailed *Croissant* is quite harmless and constantly eaten, though wherein lie the poisonous qualities of the one, to all appearance the same as the other, with the exception of the tail, has yet to be discovered. A similar fact is found in fish of the genus *Genyoroge*, called by the Creoles *Giblots*. They are mostly yellow, some with lines and others with a dark spot. The former are eaten, but the latter are always rejected. One of the family, of an intense crimson, with yellow fins, was brought to me, and I was cautioned not to let even a cat or dog get any part of it, as it was sure death in a few minutes. It is a curious fact that in nearly all the poisonous fish the most vivid colors occur. The pretty, harmless-looking little pink and yellow fish Dr. Steindachner did me the honor to name the *Pikea lunulata* is of the same deadly character. With the exception of a few of the scarlet rock cod or Serranus family, the fish with gray coats are the finest eating and the safest. The edible, bright colored ones are mostly coarse and strong to the taste—many so much so that they have to be skinned before cooking.

In the family of the *Gymnodontes* we have some of the most singular and poisonous fish of the ocean. Most of them go by the name of *Bourse*, and can inflate the body to double and treble its ordinary size. Some are covered with spines so dangerous it is exceedingly difficult to handle them, and many can bite sharply. I had a large *Diodon* sent me alive, and I asked the man who brought it if it would bite. For reply he picked up a thick piece of coral and put it in the creature's mouth, when it snapped it off as if it had been a pipe stem. Another *Diodon* was presented to the museum, called *Bon tau*, or porcupine fish. Every part of its body was covered with spines turned every way, so that it was almost impossible to touch it without pricking the fingers. It was brought to the museum with a rope round the body; but the taxidermist who skinned and stuffed the fish lacerated his fingers and they quickly ulcerated, the hand and arm swelled, and he was unable to use them well for months after.

Another fish of the same family, the *Tetrodon lunaris* (see plate), or *Bourse toto*, is equally with other Tetrodons very poisonous to man. It has no spines on the body, but has the curious appendage below that can be extended and collapsed at pleasure, covered with transparent three-sided spines of irregular shape. So many of the family have the sac that it gives the Creole name to them, viz., bourse or purse. Though its flesh is so deadly poisonous to man, like sharks and other ferocious creatures, the *lunaris* has its enemies that live and thrive on it, and doubtless in time destroy it. In one sent to the museum holes were perforated through the thick skin on the side and in the tender part of the gills, through which the parasites had made their way, and must have been very annoying to the fish. They were a bright purple and yellow. This bourse is very handsome, of an imperial blue on the back, the sides white, with a broad gold stripe extending to the eye, and the sac milk white, tuberculated between the spines. It averages about 12 to 15 inches long, and the bourse can be distended to 6 or 8 inches deep. Numbers of these fish float in the shallow waters within the reefs. Some without spines are often left by the tide on shore, which look like leather balls. The boys amuse themselves pitching them about, for, when perfectly distended, the head is almost invisible and they bounce more like a ball than a fish. When tired of playing with them, they kick them back into the water, and they soon make off. When on shore, in a collapsed state, they lie to all appearance dead; but as soon as touched by the returning tide, they recover and swiftly swim away.

Knowing my proclivities, my friends occasionally sent me a rare fish, and one day I was astonished to see a cart arrive at my door with a fish over six feet long and weighing 570 pounds! It was said to be a *Sputre*, or Serranus, and very rare, but poisonous. For hours my place was besieged by people come to see the big fish. It nearly proved a white elephant, for it was no joke to dispose of 570 pounds of poisonous flesh to get the skin. Numbers of colored men and women, Malabars, and Creoles came for it, but after what they told me I did not dare to give it to them. They clamored loudly for it, saying, "It was too bad to waste so much good flesh." At length an old fisherman, who came out of curiosity, assured me it was not the *Soutre*, but a fish that looked like it, and one he had caught years ago, and safe to eat. The poor, hungry wretches yelled with delight, and such a scene took place! As fast as the flesh could be cut out it was seized, and even the entrails and gills, and, as I heard no more about it, I suppose it was edible. It now figures in the museum at Cambridge, Mass., and Mr. Bliss wrote of it that it was supposed to be the *Serranus horridus*, which grows very large in the Indian and Chinese seas.

There are two species of *Grammistes*, black or brown, with white and lilac stripes, very poisonous, and the fishermen particularly dislike to catch them in their nets. They have an odor of strong, ill-smelling soap, that remains long on the hands after handling, as I know to my cost when skinning one. Ordinary soap and water has no effect on it, and the strongest perfume scarcely covers it. These are not all the dangers in tropical seas to fish eaters. Very often the gray mullet, one of the best eating fish in these waters when fresh, is rendered poisonous by the food taken by it occasionally. To give an instance: A friend and myself had two young mullets boiled for breakfast—one for each. After a hearty meal, in about an hour I began to feel hot and grew red in the face. Presently the color spread from my hands up the arms, and from that over the whole body in waves. I took a strong dose of carbonate of soda, by my friend's advice, and lay down, for I staggered as if intoxicated. I grew red, hot, and stupefied, and at last slept very heavily for some hours. The fever had left me in sleep, and I was ghastly white on awaking, and felt weak for several days. My Creole servant told me my mullet had eaten of the "coral flowers," as he called the coral polyps, and hence the poisoning. These fish are so greedy that often, when the large polyps are expanded, they snatch at them and get a large mouthful before it has time to contract. My friend suffered no inconvenience, as his mullet had, I suppose, taken the ordinary fish food. In consequence of this, many refuse to eat of the mullet at certain seasons of the year.

It is a curious fact that with all the abundance of fish in Mauritius it is impossible to salt it so that it will keep more than a few days. There is a species of *Teuthis* slightly salted, called *Corne*, but it has to be done fresh every three or four days, as it decays so rapidly. A little fish is salted in the St. Brandon Isles, north of Mauritius; but the bulk of the article is brought from the Cape of Good Hope and the United States.

The Mountain Sphinx.

In Surrey County, North Carolina, there is a remarkable natural curiosity in the shape of a mountain resembling the famous sphinx of Egypt in all its details. It lies east of the Blue Ridge mountains, on the Piedmont plains, like a gigantic lion; its body at right angle to the ridge and with head reared aloft as if in the act of rising. The head is of solid rock, several hundred feet in height. The shoulder and breast are finely proportioned, and at the distance of a few miles it looks like a thing of life and intelligence. It rises about 1,500 feet above the plain, and can be seen for a distance of many miles.

Fig. 1.—IRON TEST PLATE FROM THE FORGES OF CHATILLON-COMMENTRY.—[For description see page 404.]

THE NITRATE OF SODA WORKS AND FIELDS OF CHILE.

Our sketch at the top left hand shows the works of the Liverpool Company. The upper sketch at the right gives an idea of the plains where the rough nitrate is mined.

The lower engraving is a front view of the works of the Primitiva Co., which is the most completely fitted up of any of the corporations engaged in this industry.

Nitrate of soda has acquired each year a more important position in commerce and industry. It is used to make nitrate of potash or saltpeter by double decomposition with chloride of potassium. This is done at the powder works, the resulting saltpeter being used for the manufacture of gunpowder. In Europe it is used in immense quantities as a fertilizer. The agriculturists there use it as a source of nitrogen. In the United States the farming practice is so peculiar that little success has attended the efforts to introduce it here on the scale that it seems entitled to attain. If mixed in with other materials to make up a fertilizer, it destroys the pulverulence of the mixture, so that it can no longer be fed regularly by mechanical seed planters or drillers. This mechanical difficulty, trifling as it seems to be, has sufficed to keep it out of American fertilizers. If any one could invent a method of mixing it with other material so as to produce a fertilizer acceptable for American farming practice, a very important market would be opened for this product. Its efficacy is unquestioned. Throughout the continent of Europe it is used in great quantities with phosphates and potash salts by the beet root cultivators and other farmers. But in America a fertilizer that does not lend itself to mechanical feeding with perfect regularity of feed, so that a given number of pounds to the acre can be distributed, is at a great disadvantage in the market.

The formation of caliche, or nitrate, beds is attributed to the decomposition of animals and vegetables in contact with saline deposits left by the sea. In support of this opinion there is cited the frequent presence of birds' skeletons, shells, fish, guano, and the eggs of sea birds in the vicinity of the deposits of caliche, even at a depth of 10 or 15 feet under the surface, and also of iodine in the form of iodate of soda.

The richest deposits are situated upon the border of the Tamarugal pampa, in the province of Tarapaca. The depth of these varies between 6 inches and 12 feet, and they are covered with conglomerates or a crust of porphyry, and sometimes of gneiss and syenite. The Ramirez deposits cover an area of 2,600 acres. They skirt the pampa, and are situated 57 miles from the port of Iquique by rail, and 40 miles by direct mule road.

The crude product contains about 51 per cent of nitrate of soda, 26 per cent of common salt, 6 per cent of sulphate of soda, and 3 per cent of sulphate of magnesia. The remaining 14 per cent consists of earth and insoluble matter.

The caliche, coarsely broken *in situ* into 25 or 30 pound blocks, is carried by the trains to the stamping mills, which break it into pieces two inches square, whence they are sent to the dissolving boiler. The treatment consists in dissolving the caliche in the mother-water derived from preceding treatments, and allowing the solution to crystallize. There are twelve dissolving boilers, each heated by a steel worm of six spirals, in which circulates steam at four atmospheres produced in steel generators.

As soon as the solution marks 110° by the Twaddell densimeter, the steam is shut off, and things come to a standstill for a quarter of an hour, when the liquid is allowed to flow into a conduit, from whence, through secondary pipes, it reaches the crystallizing backs. Its temperature is then 115°. The residuum is washed with water, and the latter, which contains nearly all the remaining nitrate of soda, is sent to a special reservoir, from whence it is taken by a centrifugal pump and forced into the nearest dissolving boiler. When all the wash-water has been expelled, the boilers are opened and the residuum is thrown into the cars, which carry it to the dump heap.

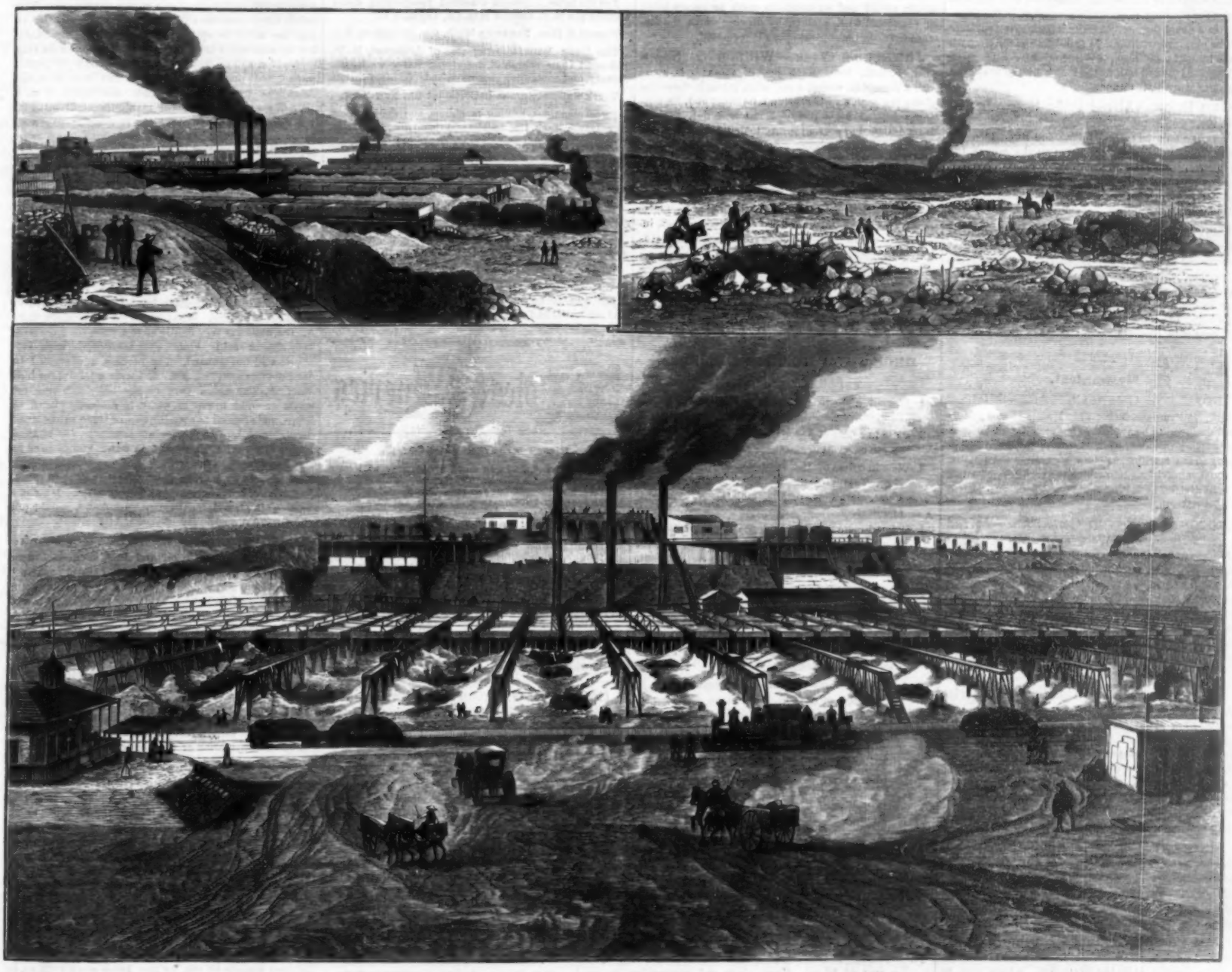
The crystallizers are ninety in number. They are 15¾ × 15¾ ft., and have a depth of 3 ft. at one side and of 2¾ at the other, so that the precipitate may be thoroughly drained. These backs are supported by a framework of Oregon pine. Under each of them there pass six joists, whose ends carry a platform which serves as a passageway for the workmen who attend to the precipitation.

After the cooling of the liquid and the crystallization, the *agua vieja*, or mother-water, is drawn off through a conduit which leads it to a cylindrical reservoir 24½ ft. in diameter and 12 ft. in height, placed on a level with the ground. From this it is pumped up for feeding the dissolving boilers. It generally marks 90° Twaddell.

The products of crystallization are afterward spread over a floor with shovels and allowed to dry in the sun. Then they are put into bags, in order to be sent to Iquique, the shipping port for Europe and the United States.

The residua still contain 3 per cent of nitrate, the greater part of which might be extracted by further washing; but this would perceptibly reduce the concentration of the mother-water, and the evaporation would thereafter become more costly.

The work goes on during the night. The grounds are illuminated by two 6,000 candle power arc lamps.



THE NITRATE OF SODA WORKS AND FIELDS OF CHILE.

Rapidity of Movements.

Science says a pianist, in playing a presto of Mendelssohn, played 5,595 notes in four minutes and three seconds. The striking of each of these notes, it has been estimated, involved two movements of the finger, and possibly more. Again, the movements of the wrists, elbows, and arms can scarcely be less than one movement for each note. As twenty-four notes were played each second, and each involves three movements, we would have seventy-two voluntary movements per second. Again, the place, the force, the time, and the duration of each of these movements was controlled. All these motor reactions were conditioned upon a knowledge of the position of each finger of each hand before it was moved, while moving it, as well as of the auditory effect in force and pitch, all of which involves at least equally rapid sensory transmissions. If we add to this the work of the memory in placing the notes in their proper position, as well as the fact that the performer at the same time participates in the emotions the selection describes, and feels the strength and weaknesses of the performance, we arrive at a truly bewildering network of afferent and efferent impulses, coursing along at inconceivably rapid rates. Such estimates show, too, that we are capable of doing many things at once. The mind is not a unit, but is composed of higher and lower centers, the available fund of attention being distributable among them.

RECENTLY PATENTED INVENTIONS.

Engineering.

LOCOMOTIVE BOILER.—John Sharkey, Winnipeg, Manitoba, Canada. This boiler is made with return flues and a smoke box at each end, a cylindrical steam drum extending horizontally above the entire length of the boiler, the throttle valve being located in the top of the steam drum, centrally through which is a chimney flue, with other novel features, the object being to promote economy in the use of fuel.

Railway Appliances.

CAR COUPLING.—Charles W. Duncan, St. Louis, Mo. This coupling is constructed with two laterally-yielding headed coupling jaws, an arrow-headed coupling bar projecting between the jaws, and an uncoupling slide or bar adapted, when thrust forward, to separate the jaws for uncoupling, the device operating to couple cars automatically, while the uncoupling may be effected without train men going between the cars.

CAR COUPLING.—Edward P. Eastwick, Jr., New York City. This invention relates to an improved coupler of the vertical plane type, and provides means for pivoting a removable knuckle in the drawhead in a novel manner, whereby large bearing surfaces will be obtained without greatly decreasing the strength of the knuckle, and also providing means for inserting and holding the tail bolt in the shank of the drawhead without removing the knuckle.

CAR ROOF.—Alfred P. Le Gros, Louisville, Ky. Combined with rabbeted roof boards in a car roof is a painted canvas folded and fitted into the rabbets, and a metallic cover fitting on the canvas, the invention being an improvement on a former patented invention of the same inventor, for a construction designed to facilitate the rapid draining of the car roof during heavy rain.

CAR STARTER. — Caleb T. Cleaveland, Kingston, N. Y. A ratchet is arranged for connection with the car axle, a pawl in a swinging frame engaging the ratchet, while cables or chains are connected to the frame, one of which is connected to a spring while the other is connected to a transverse draught lever, the parts being so arranged that the first pull of the horses will bear with increased effect on the forward axle of the car.

Mechanical.

INDEX FOR GEAR CUTTERS.—Michael Schirk, Plattsmouth, Neb. This is an indicator attachment designed to be applied to an ordinary slotting or gear-cutting machine, without material alteration of or injury to the machine, to show accurately the number of equal subdivisions into which the periphery of a disk is to be divided in cutting a gear wheel of any desired number of teeth.

AUTOMATIC KNIFE GRINDER.—Alfred E. Creigh, Ronoverte, West Va. This is a machine designed for use in planing mills, box factories, etc., automatically carrying the knife back and forth in contact with the grinding wheel, while the machine can be so adjusted that when the knife has been ground it will be automatically held from contact with the wheel, and the parts are so arranged that it will be impossible to draw the temper from the knife being ground.

Miscellaneous.

WEATHER STRIP.—Alexander L. Kirkpatrick, Orrick, Mo. This strip consists of a holder formed of a metal plate folded upon itself, forming inner and outer plates, their lower edges formed with flanges projecting toward each other, the plate or strip proper having its upper edge formed with a bead fitting in the holder, with a slot in the beaded edge, and a pin extending from the holder into the slot, making an effective weather strip which will not impede the opening or closing of the door.

LINIMENT. — Harriet E. Hoover, Lincoln, Neb. This liniment is designed as a remedy for sprains, burns, cuts, toothache, headache, and other pains or ailments, and is made of alcohol, oils of wintergreen, hemlock, sassafras, etc., compounded in proportions and after a manner described.

FAN FOR ROCKERS. — Hermann Wittmann, Rodolph, Wis. This is an attachment for rockers, cradles, swinging seats, etc., which may be readily and expeditiously secured in place without marring the furniture, whereby, as the chair is rocked backward and forward, a continuous lateral oscillating movement is imparted to the fan, a very slight rocking giving the fan an ordinarily sufficient movement.

ORGAN CASE. — Hiram E. Chute, Yarmouth, N. S., Canada. This is a casing with a fall board or key board cover which may be noiselessly opened by the depression of the pedals, the casing also furnishing means for the automatic closure of cracks around the pedals when the fall board is closed, whereby dust and vermin are excluded from the interior of the instrument.

PHOTOGRAPHIC CAMERA.—George S. Moler, Ithaca, N. Y. This is a camera more especially designed for instantaneous work, in which provision is made for storing and manipulating for exposure a series of dry plates, whereby a succession of photographs may be taken with great rapidity, and the plates used in irregular order if desired.

COMBINATION SCREEN. — Samuel Holdsworth, Brooklyn, N. Y. This is a screen made with pivotally connected arms and plates, the latter arranged for connection with a window casing, and guide or run ways engaged by eyes carried by the screen, the combination being such that the screen may be easily stowed, or it may, if desired, be used as an awning support.

ELECTRIC DOOR ALARM.—Edwin W. Taylor, Charlottetown, Prince Edward Island, Canada. This is an attachment for door locks and latches, by means of which an electric circuit will be completed when the lock or latch bolt is withdrawn, the improvement being also applicable for safes, an alarm or indicating apparatus being connected in the circuit with a battery.

CHECK PUNCH. — Samuel M. Levy, New York City. This is a device for punching into checks, drafts, etc., apertures representing numerals or figures indicating the face value of the instrument, there being a block with clamping plate to hold the paper in place, rows of lugs projecting from the edges of the plate, and punches, each having on one of its prongs a pin fitting between the lugs on the clamping plate.

DRAWING AND MEASURING INSTRUMENT.—William G. Curtis, Philadelphia, Pa. This is a combination instrument in which is included a rule, dividers, calipers, beam compasses, squares, etc., the rule being adapted to use as an ordinary rule in the usual manner, and the invention covering novel parts, details, and combinations.

RULING PEN. — Reinhold Handel, Leipsic, Saxony, Germany. This is an adjustable pen, more particularly designed for ruling the stave lines for writing music, its essential feature being that the distance between the several lines drawn by it can be readily varied and adjusted, its teeth or points being all connected with a slide, by moving which the distance between the separate pens is regulated.

JEWELER'S VISE.—William G. Sheppard, McCook, Neb. Each jaw of this vise is made with a horizontal recess, a seat plate fitting in the recess of one jaw with a spring behind its inner end, its tension regulated by a threaded rod and nut, the vise being designed to prevent injury to delicate work which might be injured by being clamped too tightly by the jaws.

WAD PULLER. — Myron A. Twitchell, Moville, Iowa. This is a device in which a plunger is movably held in a body portion, the plunger having at its inner or lower end a laterally operating gripper, intended for use in removing wads from shells when it is desired to remove the load.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1640) J. B. G. writes: We have a well 65 feet deep, the water rises 7 feet above the surface. Water analyzed with the following result, parts per 100,000: Oxygen required 0·11, free ammonia 0·010, albumenoid ammonia 0·005, nitrous acid trace, chlorine 2·21, total solids 28·2. 1. Would this be regarded as good water for public supply? A. It is apparently an excellent water. The chlorine is perhaps a little high. 2. Is it what is called hard or soft? A. The analysis does not disclose this. It cannot be seriously hard. 3. Please reduce it to grains per gallon. A. Multiply by the decimal 0·58333 to effect the desired reduction.

(1641) W. H. L. asks: 1. Where, on what kind of bottom, black bass are to be found. A. Black bass are found on all bottoms, but the rocky bottom is probably the best. 2. Is a muscalonge an overgrown pickerel? A. The muscalonge is a distinct species.

(1642) W. W. P. asks: What books would be of benefit to me? I am a pattern maker. A. We can mail "Pattern Making" by a foreman pattern maker, 379 illustrations, $3.

(1643) W. B. asks (1) Where to obtain ebonite used on the reel of an induction coil. A. From any dealer in electrical supplies. 2. How can I make any desired form of it I want? Can I mould it like lead? A. By turning, sawing, and filing. It cannot be melted and cast. 3. Where can I get cartridge paper? A. Use any thin, strong paper. 4. Does it make any difference how the wire is wound on the reel of an induction coil, whether it is from west to east, or east to west? A. No. 5. Is double insulated wire better to use than single insulated wire? A. Use good quality single insulated, relying on the shellac, etc., to perfect the insulating. 6. A firm who deal in Geissler tubes. A. Consult our advertising columns for dealers in scientific apparatus.

(1644) A. G. U. asks: What is the velocity given a solid body three feet long, weighing fifty pounds, in a 10 inch tube, fitting as neatly as a piston fits in a cylinder, by compressed air, at any given pressure you may select, that is, if the air follows the body, forcing it forward, what distance will the body travel before requiring a new supply of air to continue the body at the highest speed? What will be the friction to be overcome, and what is the most economical pressure of air and weight of body to use? What material should be used for best results? What do you know from actual practice here and abroad—Paris, for instance—on the subject? What effect do curves have upon it? A. We have no practical example of a heavy body as a piston moving in a long tube at high velocities. The pneumatic gun is a successful example of a heavy shell projected by an impulse of compressed air for a short distance, a full description of which may be found in back numbers of SCIENTIFIC AMERICAN SUPPLEMENT. In a long tube a given volume of compressed air would only follow the moving body with decreasing pressure for the distance due to the amount of compression. The pressure of air must be constant behind the piston or shell within a pneumatic tube in order to keep up the speed or velocity for any considerable distance, and also greater than the friction of the piston on the tube as well as friction of the air upon the sides of the tube, and to supply windage or leakage. The moving piston should be as light as possible and of a nature to cause as little friction as possible, for friction generates heat, and the piston in a long pneumatic tube might accumulate heat enough to injure it or its contents. Pneumatic tubes in use in New York have curves on a radius of 20 to 30 times their diameter, with pistons about three times as long as wide; with these proportions the pistons run freely. They are made of thin steel covered with leather. See SCIENTIFIC AMERICAN, October 19, 1889, for illustrated description of the Johnson pneumatic tube with a rolling ball.

(1645) O. B. J. asks (1) how to split paper. A. Paste the paper between two sheets of very firm paper. When the exterior is quite dry, pull the two sheets apart, and one-half will adhere to each sheet. The points are to have the outer sheets stronger and firmer than the one to be split, and to have the latter nearly but not absolutely dry. The best flour paste works very well. If mucilage be used, it may penetrate the paper, when it will prevent splitting. It can also be sometimes done by soaking the paper and laying it on a plate of glass, and by careful manipulation dividing it. 2. A medium by which paper can be made transparent. A. Castor oil. 3. What to use to mount transparent paper on glass, so that it will retain its transparency? A. Mount with flour paste, and when perfectly dry saturate with castor oil. Dammar varnish or Canada balsam may be used to mount and render transparent in one operation. Or the paper may be wet, attached to the previously varnished glass, which has been allowed to dry until tacky, and when perfectly dry can be thinned by rubbing with the wet finger. A final varnishing completes the operation.

(1646) W. V. E. writes: I have seen what looked like plain glass, but by breathing on it you could see a picture. What was used to produce this? A. The design is very lightly etched upon the glass with hydrofluoric acid. Fluor spar moistened with sulphuric acid can be used. The process is described in our SUPPLEMENT, No. 378. 2. I want a receipt for bird lime. A. The middle bark of the holly is boiled for seven or eight hours in water, is drained, placed in heaps, and allowed to stay for two or three weeks until decomposed into a species of mucilage. It is then beaten in a mortar, kneaded with water, and allowed to stand in stone jars for four or five days. An inferior kind is made by boiling down linseed oil until thick. In the latter operation there is danger of sudden combustion; it should be done out of doors, and the pot should be kept covered.

(1647) A. T. writes: 1. How can I make axle grease out of resin oil and lime, such as Fraser axle grease? A. Dissolve ¼ pound caustic soda in 1 gallon water, add 3 pounds tallow and 6 pounds resin oil or 10 pounds oil alone. Heat to 210° Fah., stir and mix as it cools. 2. Can I feed hogs with oil cake from castor beans pressed in an hydraulic press? A. We should not recommend it. 3. I send you a sample of earth found in the neighborhood of this city; please state of what it is composed, and how I can bleach it snow white in order to fill soaps with it? A. Only by treatment with acid, which will probably make it too expensive. It contains silica, alumina and oxide of iron. 4. Has it any value as color? A. No. Possibly it might be of value for brick or terra cotta.

(1648) K. G. asks (1) if meats disinfected by chlorine or chloride of lime putrefy afterward. A. They may, if the chlorine escapes completely. 2. Would the chloride of lime prevent their use? A. It would. 3. Is Labarraque's liquor equal to chlorine as a disinfectant? A. It is about the same thing as regards efficiency. One being a gas and the other a liquid, a direct comparison is not easy. 4. Is Javelle water the same as Labarraque liquor? A. Javelle water is the same as the other, except that it contains less soda and more chlorine. 5. Which of them has the least odor? A. Javelle water freshly prepared would have the greatest odor.

(1649) L. C. asks: 1. Have you ever de- scribed a motor of one or two horse power? If so, in what number? A. No. 2. Could the eight light dynamo described in No. 600, SCIENTIFIC AMERICAN SUPPLEMENT, be used as a motor? A. Yes. 3. If so, should any changes be made? A. No. 4. About what power would the eight light dynamo develop used as a motor? A. About 1 horse power. 5. What power would the eight light dynamo develop used as a motor increased to twice the size of the one described in No. 600? A. If twice the size linear, it would be about 5 horse power. 6. What power would this motor develop if the field magnets only are increased to twice the size? A. This would give an undesirable proportion, with no advantages.

(1650) B. B. asks: In the event of light- ning striking an iron roof to a building, what would the effect probably be? Would the force of the electric current be dissipated by diffusion over a large surface, or would it demolish the roof? If the latter, what precautions ought to be taken to avert disastrous consequences? A. A metallic roof is an element of safety. If there are no rods, the lightning seems to divide and make its way by several paths to the ground. To prevent disaster, the roof should be connected by several rods to earth. The rods should be well grounded.

(1651) W. B. G. asks: What is the best instrument for the drawing of an ellipse, and where can it be obtained? A. For drawing ellipses trammels may be used. They are sold by dealers in drawing materials. Ellipses can be drawn by the use of a thread and two pins. The pins are driven into the foci of the curve, the thread is tied loosely around them, and a pencil placed against the thread and straining it outward if moved around, will describe the desired curve.

(1652) J. G. asks how to make artificial ivory. A. Many processes have been used. One simple though not the most effective method consists in mixing powdered barytes with solution of white gelatine to a paste and compressing it into moulds. The above may be soaked in strong alum water with advantage.

(1653) M. L. writes: Can you recommend any method of finishing water color with a gloss? What I wish is enamel finish. A. Try varnishing with dammar varnish or Canada balsam. Good results may be obtained by cementing the picture closely against a sheet of transparent celluloid film.

(1654) S. G. asks if a current of the Edison electric light can be used for brass or copper plating of small objects of about 5 by 10 inches square. A. The current has too high a potential. This you can reduce by inserting resistance before or after your bath, equal in amount to about twenty times that of the bath.

(1655) Subscriber.—For electric wiring of buildings from a practical standpoint we recommend "Incandescent Wiring Hand Book," by Badt, $1, and also our SUPPLEMENT, Nos. 603 and 699, which we can supply for 10 cents each.

(1656) P. O. D. asks: On what does the strength of current in a thermo-electric series depend? A. On the nature of the substances composing the couples, on their number and order, and on the difference of heat at opposite extremities. Experiments only can determine the relative thermo-electric potential of different combinations.

(1657) C. W. writes: Will you inform a reader how to remove raw linseed oil from a fine quality of brown stone, such as is used for steps? A. Our best advice is to oil the steps all over with the same oil. You cannot remove it without leaving a stain.

(1658) J. W. L. says: Please inform me how the calibers of shot guns are numbered and what part of an inch do the Nos. 8, 10, 12, 14, 16, 18 and 20 represent. I wish to make some gun tools and have not the desired information. A. No. 8 "'85 diameter, No. 9 "'81, No. 10 "'79, No. 12 "'75, No. 14 "'72, No. 16 "'69, No. 18 "'66, No. 20 "'63, No. 22 "' 62, No. 24 "'61.

(1659) E. R. asks for the simplest and most effective method of affixing connection on carbon pole of Leclanche battery, to prevent the creeping up of the salts and the consequent corrosion. The carbons I use are electric light pencils, and cannot very well be drilled through. A. Heat one end of each rod, and fill its pores for about an inch with paraffin. Cast lead around the paraffined ends of the rods.

(1660) D. E. W. asks: 1. What can I paint the coils of the field magnet and armature of simple electric motor with, so as to have them a bright red color? A. Use shellac with a suitable pigment, English or Chinese vermilion. 2. I used tinned iron wire for my armature ring. Will it work as well as if it were bare? A. Yes. 3. How large a candle power incandescent lamp is equal to a common kerosene light? A. 8 candle. 4. Would the battery you describe to run the motor run such a light? A. Yes. 5. How many cells, consisting of two carbon plates 5×7 and one zinc 5×7, would it take to make the motor turn? A. One or two cells will make it turn. 6. Could I charge a one gallon storage battery through the day with "disque" Leclanche cells to run a 4 or 6 candle power lamp an hour or so in the evening? How should I connect it if I could? A. The Leclanche cell is not adapted to this use. 7. What do the pocket batteries which are used to run the small incandescent scarf pins consist of? What solution is used for charging? A. Carbon and zinc plates and a bichromate solution. 8. Can I produce light, by a battery, between two carbon points ⅛ inch in diameter or smaller? How large a battery will I need? A. Yes, 50 to 60 cells of Bunsen or Grove. 9. I have a number of carbons which have been used in a Leclanche "prism" battery until the battery refused to work. Now, will these carbons work nearly as well (as new ones) in a bichromate battery? A. They would work very well.

(1661) W. S. V. B. asks for a formula for making dry plate lantern slides. A. Use the Eastman or Carbutt transparency dry plate, 3¼×4, expose in contact with the negative, three seconds, about two feet distant from a gas burner. Develop the image with following developer:

Water	1½ oz.
Sulphite soda	50 grs.
Eikonogen	4 grs.
Carbonate of potash	3 grs.

After development wash and fix in hyposulphite soda 20 grains, water 1 ounce. Wash for 20 minutes in changing water, then dry. For projecting the slides on a screen use a ¼ Dariot portrait lens and a 4 inch condenser. The requisite lantern may be had from manufacturers of optical goods, such as Queen & Co., Philadelphia, Pa.

(1662) Z. W. asks (1) how to get a good polish on mahogany easily. A. Mix one part of boiled linseed oil with two parts of alcoholic shellac varnish. Shake well before using. Apply in small quantities, with a cloth, and rub the work vigorously until the desired polish is secured. 2. I am making a mantel ornament; what shall I place between the woodwork and the chimney, to prevent the heat from doing injury? A. A piece of polished sheet metal. 3. How to rid a flower pot containing a century plant from ants, which has been standing in the yard all summer? A. Try filling the earth in the pot with tobacco smoke. It is said that leaves of green wormwood scattered about will disperse ants.

(1663) D. B. H. says: The creek touching our house during heavy rains gets very high and wild. When the water reaches a certain height (from 5 to 8 feet above low water line), the wells in the vicinity of 850 to 1,800 feet get very cloudy, water tasting slightly of iron properties, yet after these incessant rains the wells (among them an artesian well) have become perfectly clear and water has a fresh taste. What is the cause? A. The cloudiness in the well water at times of severe rains is no doubt caused by surface leakage, either by soakage through the top soil near the well or by direct drainage into the wells. The carelessness in regard to well surroundings all over the country is remarked by many observers having experience in these matters. The same condition as to surface infiltration into pumping artesian wells is also observable. Water entering wells through the proper channel is filtered in all seasons alike, and should never be cloudy or muddy. Too often the spill of a pump is allowed to form a mud puddle around the well, which leaches the poison-breeding water back into the well —sources of fever and disease.

(1664) A Reader asks (1) for the process of silvering glass. I have a small galvanometer mirror from which the back has worn off, and I desire to replace it. A. Place a drop of mercury on the back of a small piece of looking glass, and the coating will become so loosened that you can push it off over the edge and catch it upon the back of your galvanometer mirror. Or you can silver it thus: Form a rim of beeswax around the edge, and pour upon it a solution of nitrate of silver containing a slight excess of ammonia, or a little more than enough to dissolve the brown oxide first formed by its addition. Ten grains of nitrate of silver to one ounce water is sufficient. To this add as it lies upon the glass half as much of a solution of the same strength of Rochelle salts in water. It should then be warmed to 70° or 80° Fah. by being placed near a fire or in the sun. 2. The recipe for making draughtsman's black and red liquid ink. A. For black, grind up India ink in a strong solution of borax. For red, dissolve 1 drachm carmine in ½ drachm liquor ammonia 0·880 sp. gr. Dissolve 20 grains gum arabic in 3 ounces of water, and mix the two solutions.

(1665) S. L. H. asks: 1. What is the specific gravity of the oil of juniper? A. 0·850 to 0·880 at 59° Fah. 2. What is its boiling point? A. 306° to 309° Fah. 3. Where is the paper called *Chemical News* published? A. London, England. 4. Where is dynamite manufactured? A. In the United States and in Europe in a number of places. 5. What book has been published on essential oils and their manufacture? A. We recommend Brandt on "Animal and Vegetable Fats and Oils," which we can supply for $7.50. 6. Is there any book published upon the manipulating of glass tubes and glassware, for the amateur? A. We recommend Shenstone's "Methods of Glassblowing for Amateurs," which we can supply for 80 cents. 7. Give a recipe for making an ink which will fade in say twenty-four hours, and a chemical which will bring it back again. A. Write with nitrate of silver and a quill pen. Restore by exposure to hydrosulphuric acid vapor.

NEW BOOKS AND PUBLICATIONS.

REPORTS ON THE OBSERVATIONS OF THE TOTAL ECLIPSE OF THE SUN OF JANUARY 1, 1889. Sacramento. 1889. Pp. xx, 210.

The title of this book sufficiently designates its contents. It gives the work done in observing the total eclipse of the sun in California, not in only at the Lick Observatory, but by independent observers all over the State as well. It is published by the authority of the leading university of California, and forms a most important and valuable addition to the Lick Observatory publications. The photograph given as frontispiece showing the corona during total eclipse is a gem in its way.

LA LUMIÈRE ELECTRIQUE. By L. Montillot, director of military telegraph. Paris: J. & B. Bailllire et Fils. Pp. 408.

The subject of generators, lamps, distribution and application of electric light, are given in great detail in this volume, which is very profusely illustrated. The practical portions relating to machines on shipboard and in theaters are especially entertaining for the general reader, while its numerous *resumes* of all the changes that have been introduced in the science and of all the applications, with its numerous illustrations, make it of value to all.

ALTERNATE CURRENT MACHINERY. By Gisbert Kapp, A.M.I.C.E. New York: D. Van Nostrand Company. Pp. 199. Price 50 cents.

This addition to the well known Van Nostrand series, because of the present interest in the subject and the eminence of its author, may be said to have an especial value. It is illustrated where required.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 10, 1889,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adjustable gauge, P. Nathan 416,737
Advertising devices for show windows, means for operating, C. E. Naylor 416,848
Air brake attachment, W. Rymer 416,953
Alarm. See Door alarm.
Alarm lock, J. W. Parrish 417,079
Annunciator, electrical, F. S. Carter 416,712
Axle box, car, E. U. Benedict 416,800
Bag fastener, R. Wilson 416,771
Bar. See Cutter bar. Detector bar. Harvester sickle bar.
Bark from tree sections, machine for removing, T. F. Horn 416,784
Battery. See Secondary battery. Stamp battery.
Battery plate, secondary, V. H. Ernst 417,186
Batting, machine for folding and compressing cotton, H. Rembert 417,092
Bed, folding, J. D. Ennes 417,157
Bedstead, folding, W. D. Snyder 417,108
Bee feeder, F. E. Merriman 416,935
Beehive stand, S. Lipp 416,931
Belt, voltaic, F. A. Phillippi 416,803
Berth register for sleeping cars, electric, F. E. Leibnitz 417,052
Berths, passenger recorder for sleeping car, F. E. Leibnitz 417,051
Bill or file holder, W. H. Cushing 417,155
Billet forming, process and mechanism for, Smith & Pottigrew 416,962
Blade holder, W. O. Cree 416,902
Boat. See Life boat.
Boiler. See Locomotive boiler.
Bolt, H. E. Smith 417,105
Boot or shoe, J. L. Joyce 417,044
Boot or shoe, L. E. Scafe 416,861
Boots or shoes while being operated upon, jack for holding, G. H. Clark 417,148
Boring implement, J. W. Thackara 417,116
Bottle stopper, R. Bloeser 417,139
Box. See Axle box. Locomotive fire box. Paper box.
Box, O. V. Blittersdorff 416,892
Boxes, machine for attaching metal clips to cardboard, J. Geiger 416,906
Bracelet, W. H. Ball 416,887
Braiding machine, T. Finigan 416,905
Braiding machine, D. D. Griffin 417,172
Brake. See Car brake. Power brake. Truck brake.
Brake heads, balance spring for, C. C. Higham 417,181
Bridge, suspension, G. W. Little 417,054
Bridges, foundations for signal rods for draw, J. T. Hambay 417,177
Buckle, J. Beattie 416,985
Buckle and snap hook, combined, C. Smith 416,868
Buckle, strap, C. Smith 416,759
Buckle, suspender, J. Myers 416,942
Buggy washing device, C. R. Butts 416,824
Burner. See Gas burner. Hydrocarbon burner.
Butter, etc., case for packing, J. F. Rusling 416,751
Button fastener for gloves, etc., spring, J. Kershaw 417,191
Button hook, G. W. Mable 416,932
Calendars and memoranda combined, holder for, H. P. Smith 417,106
Camera. See Photographic camera.
Can. See Oil can.
Can opener, O. W. Ekman 417,010
Can opener, A. Hunter 417,032
Candy tray, E. F. Landis 417,049
Car brake, C. A. Cook ..... 416,906 to 416,908
Car brake, C. V. Roto 416,749
Car coupling, C. W. Duncan 417,005
Car coupling, E. P. Eastwick, Jr 417,006
Car coupling, J. Skinner 417,103
Car door, freight, D. Manuel 416,793
Car, dumping, W. J. Bostain 416,804
Car gate, Webber & Pratt 416,768
Car heating device, W. Vogel 416,877
Car pedestal, W. Behrens 416,774
Car, railway, P. D. Whitehead 417,126
Car roof, A. P. Le Gros 416,928
Car starter, C. T. Cleaveland 416,904
Cars or other vehicles, wheel fender for tram, L. Porri 417,085
Cars by steam and hot water, system of heating, R. D. Kimball 416,844
Cards and paper, apparatus for finishing the edges of, E. J. Smith 416,869
Carpet fabric, two-ply ingrain, F. W. Read 417,090
Carpet stretcher, Foster & Barker 416,725
Carriage, child's, C. Rousseau 416,750
Carriage, child's, H. H. Speck 417,109
Carriage seat, R. M. Stivers 416,872
Carrier. See Cash carrier. Thrashing machine straw carrier.
Car seat, movable, W. H. Lingle 417,053
Cart, self-loading dirt, S. M. Stevenson 416,964
Cart, soldiers, H. Gentsen 417,017
Case. See Instrument and medicine case. Organ case. Show case.
Case for delivering cigarettes, etc., S. Berge 417,147
Cash carrier, F. S. Church 417,147
Cash carrier, T. M. Kenney 416,923, 416,924
Cash carrier apparatus, R. W. Soper 416,870
Casting apparatus, stereotype, J. R. Cummings 416,717
Casting ingots or billets, H. Aiken 416,705
Chain, sheet metal, F. Egge 417,007
Chair, P. Flowers 416,906
Chair and lounge, combined, J. M. Groff 416,837
Cheese vat, E. Wagner, Jr 416,766
Chopper. See Cotton chopper.
Churns, motive power for, C. W. Slagel 417,104
Cigar bunching machine, C. H. Hauck 416,911
Cigar bunching machine, Hauck & Weinigmann 416,912
Clasp, T. Walker 417,124
Clasp and tag, M. Moose 416,796
Cleaner. See Grain cleaner. Slate cleaner.
Clock movement and the like, H. S. Prentiss 416,804
Closet. See Wash-out closet.
Clothes line, H. E. Percival 416,854
Clothes pounder, G. C. Bronner 417,209
Clothes rack, folding, J. & J. J. Kauffman 416,843
Clutch appliance for elevators, C. R. Pratt 417,086
Coat and hat hook, G. W. Wright 417,128, 417,129
Coat and vehicle apron, combined, S. C. Horn 417,028
Coffin, D. R. Johnson 417,042
Coffin fastener, J. H. Scott 416,956
Coins, setting for, T. F. Gaynor 417,016
Combination screen, S. Holdsworth 417,027
Commutator, J. A. Dalzell 416,720
Compound engine, A. J. Pitkin 417,083
Concrete mixing machine, E. L. Ransome 416,950
Corn sheller, hand, B. A. Mathewson 417,063
Cotton and preparing it for spinning, etc., machinery for ginning, H. U. Allen 416,886
Cotton chopper and cultivator, combined, B. Whitehead 416,980
Cotton gin feeders, distributer for, J. L. Williams 416,983
Coupling. See Car coupling. Pipe coupling. Pipe or hose coupling.
Culinary utensil, S. N. Bryan 416,711
Cultivator attachment, J. A. Harris 416,727
Cutter. See Paper cutter.
Cutter bar, Parker & Clark 416,738
Cutting square holes, machine for, W. O. Gunckel 417,174
Dental instrument, L. C. Bryan 416,989
Detector bar, A. H. Johnson 416,921
Die. See Watch case die.
Digging machines, tooth and tooth carrier for, W. J. Young 416,982
Disinfecting apparatus, E. L. Stream 417,113
Ditching machine, A. J. Meals 416,934
Door alarm, electric, E. W. Taylor 416,971
Door check, W. H. Clark 417,149
Door check, V. C. Trabold 416,874
Door check, pneumatic, Smiley, Jr., & Shea 416,758
Doubletree spring, J. A. Simpson 416,757
Draught equalizer, J. Kauffman 417,190
Draught gear for vehicles, G. M. Rust 416,752
Draught hook, G. Harvey 417,180
Drain testing apparatus, B. Meriam 417,210
Drawing and measuring instrument, combined, W. G. Curtis 416,719
Dredging apparatus, W. P. Humphreys 417,185, 417,186
Dredging conduit support, W. P. Humphreys 417,187
Dredging scraper, J. C. Coult 416,949
Drier for fruit and like articles, G. & F. Frick 417,014
Drill. See Rock drill.
Dust conveyer, W. S. Miller 416,936
Dyes, making azo, R. Greville-Williams 417,207
Electric conductor, Saville & Winspear 417,095
Electric conductors, drop switch for, C. J. Van Depoele 417,120
Electric light support, Schardt & Lutzenberger 416,962
Electric machine, compound dynamo, F. B. Rae 417,089
Electric motors, coupling, E. W. Rice, Jr 416,746
Electrodes for secondary batteries, preparing, J. K. Pumpelly 417,088
Elevator. See Harvesting machine elevator.
Elevator, C. R. Pratt 417,087
Elevator or carrier apron, endless, I. M. Miller 417,095
Elevator starting and stopping device, C. W. Baldwin 416,983
Embroidering machine, R. T. Smith 416,811
Engine. See Compound engine. Rotary steam engine. Steam engine.
Engine link, Stiles & Cross 416,965
Engine link motion, C. L. Eberle 416,723
Engineer's seat, H. W. Knapp 417,192
Equalizer, four horse, P. Baker 416,822
Eraser, rubber, F. W. B. McCreedy 417,073
Evener, three horse, Reinemer & Lang 417,091
Excavating, grab bucket or digger for, H. Grafton 416,836
Explosive energy, method of and apparatus for utilizing, W. Vogel 417,123
Extracts, apparatus for making, I. Giles 417,168
Extracts, apparatus for obtaining, L. Schultz 417,096
Eyeglass frame, L. Riemenschneider 416,857
Fabric. See Carpet fabric.
Fan attachment for rockers, H. Wittmann 416,981
Fan attachment for rocking chairs, C. S. Mitton 417,097
Fare boxes, safety attachment for, L. F. Heck 416,915
Farm gate, R. Thompson 417,118
Feed regulator, M. A. Swing 416,988
Feed water regulator, R. Willetts 416,978
Feed water regulator and low water alarm, Cook & Thoens 417,150
Feeder, coagulant, J. W. Hyatt 417,034, 417,046
Feeder, coagulant, C. H. Kendrick 417,046
Feeding reagents, apparatus for, J. W. Hyatt 417,045
Fence, W. T. Manry 416,933
Fence, portable worm, B. F. Swift 417,205
Fence post, J. W. & J. A. Osborn 417,077
Fences, tension device for wire, D. H. Scott 416,955
Fencing, M. D. Cummings 416,718
File, bill, H. Johnson 417,045
File or rasp, J. Ridge 416,895
Filter, R. Morris 417,070
Filter bed, granular, J. W. Hyatt 417,037
Filter strainer, J. W. Hyatt 417,038
Filtering apparatus, Shufeldt & Lynch 416,886
Filtration, apparatus for upward, J. W. Hyatt 417,044
Fire extinguisher, V. A. Harder 416,835
Fire extinguisher, automatic, E. P. Gleason 416,779
Fire extinguishers, automatic sprinkler nozzle or valve for, W. Harkness 417,025
Fire extinguishing system, automatic, Simmons & Hepburn 416,867
Flag staff holder, T. C. Clark 416,901
Floor for buildings, F. Furness 416,907
Fluid trap, P. R. Gray, Jr 417,171
Flushing apparatus, R. Walsh 417,125
Flushing tank, I. Shono 417,100
Fork. See Hay fork.
Fork, pan, and stove lid lifter, combined, J. W. McPherson 416,796
Frame. See Eyeglass frame.
Fur dressers, hair clipping bench for, E. Schroeder 416,864
Furnace. See Gas furnace. Hot air distributing furnace.
Gauge. See Adjustable gauge. Speed gauge.
Garment, suspensory, C. C. Taylor 416,970
Gas and air, apparatus for mixing, E. B. Denny 416,776
Gas, apparatus for the manufacture of, T. J. Close 416,825
Gas burner, coal oil, L. J. W. Birn 416,986
Gas burner safety attachment, M. Siersdorfer 417,101
Gas burner safety attachment, R. P. Williams 416,979
Gas burner, self-lighting, E. S. Allen 416,707
Gas furnace, regenerative, C. M. Ryder 416,753
Gas governor and pressure regulator, N. J. Ditto 416,722
Gas light safety catch, J. D. Bowman 416,895
Gas lighter, electric, N. Newman 417,075, 417,198
Gas lighting torch, taper case, and match box, combined, Houchin & Riker 417,030
Gas, obtaining hydrogen, Mond & Langer 417,008
Gas pressure regulator, H. J. Bell ..... 417,134 to 417,136
Gate. See Car gate. Farm gate.
Gate, J. C. Alexander 416,885
Gate, A. O. Hess 416,729
Gear cutting machines, index plate for, M. Schirk 416,954
Generator. See Steam generator.
Glass mould, R. D. Haines 417,176
Glass, mould for curving plate, J. Scott 417,097
Gold from ores, extracting, G. W. Goets 416,781
Governor and cut-off valve gear, J. D. Gray 417,170
Grain bins, electric indicator for, Thompson & Newton 417,117
Grain cleaner, B. Holt 416,916
Graining, F. A. Walters 416,976
Grate, J. H. Knox 416,789
Grinder, automatic knife, A. E. Creigh 417,091
Guard. See Hand guard.
Guitar, E. J. Cubley 416,715
Guns, apparatus for facilitating the loading of, J. B. G. A. Canet 417,145
Gutter section and fastener, W. H. Hawkins 416,914
Hame fastener, N. Lage 416,926
Hame fastener, J. L. O'Connor 416,852
Hammer, foot power, M. Redlinger 417,201
Hammock, A. Fortenbaugh 417,161
Hand guard or shield, A. H. Neale 416,849
Handle rack, S. S. Underwood 417,119
Harness attachment, J. Peterson 416,945
Harrow, Hollister & Hall 417,183
Harrow and cultivator, double side, M. B. Gooing 416,909
Harrow, spring tooth, C. W. Conklin 416,905
Harvester sickle bar, J. A. Sowell 416,963
Harvesting machine elevator, C. D. Towne 416,764
Hay cap, J. H. Rice 416,747
Hay fork, J. Horn 416,917
Hay press, L. J. Brown 416,899
Heat registers, drying rail and foot rest for, M. A. Sims 417,103

Heater. See Soldering iron heater.
Heating, liquid composition for use in systems of, M. Wanner 417,213
Heating vessels or chambers by steam, C. Jones .. 417,189
Heel seats, machine for beading, J. S. Matthews .. 417,062
Hinge, shutter, T. Steckel 417,111
Hinge, spring, H. W. Ketcham 417,047
Hoeing machine, J. B. Hurd 416,840
Holdback, vehicle, H. J. Welch 416,818
Holder. See Bill and file holder. Blade holder. Flagstaff holder. Opera glass holder. Paper holder. Paper bag holder. Photograph camera plate holder. Pipe holder. Shade holder. Soap and brush holder. Spool holder. Ticket holder. Trolley holder. Umbrella holder.
Hook. See Button hook. Coat and hat hook. Draught hook.
Horseshoe nail, W. W. Miner 417,096
Hose reel, W. T. Y. Schenck 416,863
Hot air distributing furnace, E. Molloy 416,734
Houses, construction of, R. Milde 416,795
Hydrocarbon burner, J. A. Cowles 417,152
Incubator, S. C. Campbell 416,774
Induction coil, transformer, etc., E. Thomson 416,762
Ingot mould, H. Aiken 416,706
Inkstand, A. P. Pichereau 417,082
Instrument and medicine case, P. A. Lilly 416,790
Iron, purifying, T. Twynam 416,814
Jack for raising cars, H. F. Campbell 416,940
Knife. See Pocket knife.
Lamp hanging device, electric arc, J. McLaughlin 416,847
Lantern, A. H. & J. T. Crawford 417,030
Lantern, C. J. Higgins 417,036
Lantern, signal, W. P. Myer 416,799
Lantern, signal, W. Nelson 416,850
Leather, machine for treating, M. N. Howard 416,918
Life-boat, W. Lath 417,195
Lifter. See Lid lifter. Pan lifter. Transom lifter.
Lifting and compressing device, S. B. Minnich 416,793
Liniment, G. Evert 417,011
Liniment, L. Hilke 416,730
Liniment, J. G. & P. H. Knipper 417,048
Link lifter, F. G. Grove 417,023
Lock. See Alarm lock. Nut lock. Wagon seat lock.
Lock, F. Eggo 417,008
Locomotive, Faithful & Simpkin 416,724
Locomotive boiler, J. Sharkey 416,958
Locomotive fire box, W. Maism 417,059
Locomotive steam engine crosshead, J. A. Stiles .. 416,999
Loom, E. H. Graham 417,020
Loom let-off mechanism, G. F. Hutchins 417,085
Loom temple, J. G. Avery 416,708
Malting machine, A. Wiggin 416,769
Match sticks, machine for making, O. C. Barber et al 416,888
Matrix making machines, circuit closing device for, C. L. Redfield 416,742
Matrix making machines, escapement device for, C. L. Redfield 416,743
Matrix making machines, feed device for, C. L. Redfield 416,744
Matrix making machines, impression device for, C. L. Redfield 416,741
Matrix making, type die for, C. L. Redfield 416,740
Mercury, extinguishing, A. Sommer 416,700
Metal cutting and punching machine, J. H. Sanders 416,860
Metal flanges, making wrought, Van Wagenen & Graves 416,816
Metal planing machine, L. W. Pond 417,084
Metals by electricity, cutting, B. C. Tilghman 416,873
Metals from ores, plant for the extraction of, G. W. Goetz 416,780
Metallic rosette, L. L. Sagendorph 417,094
Milking machine, cow, J. J. Lefeber 417,050
Mill. See Roller mill. Rolling mill.
Mould. See Glass mould. Ingot mould.
Mop, A. W. Page 417,078
Mortising machine, C. Seymour 417,098
Multiple switch board testing apparatus, C. E. Scribner 416,808
Multiple switch boards, test circuit for, C. E. Scribner 416,809
Musical instrument, stringed, C. G. Schuster 416,756
Musical instruments, making reeds and reed plates for, M. Bray 416,897
Musical instruments, reed for, Morgan & Dawes .. 417,069
Musk, making artificial, A. Baur 416,710
Nail. See Horseshoe nail.
Nut lock, J. F. Shoop 416,960
Oil burning apparatus, W. Vogel 416,876
Oil can, P. J. Moore 416,939
Oiler, E. L. Rand 416,949
Opera glass holder, J. S. Spencer 416,871
Oranges, etc., for shipment, preparing, S. Farwell 416,854
Organ case, H. E. Chute 416,993
Organs, pneumatic action for pipe, J. E. Treat 416,974
Oven, A. W. Howard 416,839
Paddle wheel, feathering, R. Forward 417,102
Pail support, milk, J. W. Bliss 416,987
Pan lifter, J. E. Mason 417,061
Paper bag holder, J. Lee 416,845
Paper bags, machine for stringing, J. J. West 416,819
Paper box, B. Osborn 417,076
Paper box machine, T. Flynn 417,012
Paper cutter, Boyer & Geyer 417,140
Paper fastener, H. A. Free 417,105
Paper holder and cutter, roll, J. B. Lawton 416,927
Paper holder, toilet, C. C. Johnson 416,842
Paper reel with printing attachment, H. T. Wilcox 416,821
Paper roll machines, rewinding shaft for, R. W. Grosvenor 416,792
Paper to be used for perforating, etc., adhesive, G. H. Davis 416,721
Paper vessel, J. L. Sefton 416,810
Paper vessel, J. Veneman 416,817
Papers and the like, device for stringing, R. P. Stansbury 417,110
Pen, fountain, G. S. Parker 416,944
Pen, ruling, R. Handel 417,024
Photograph burnishing machine, H. Crary 417,153
Photographic camera, O. Anschutz 417,131
Photographic camera, G. S. Moler 416,938
Photographic camera plate holder, M. Juruick ... 417,045
Photographic films, manufacture of flexible, H. M. Reichenbach 417,092
Piano action, P. Krumscheid 417,191
Pianoforte protector, G. W. Warren 416,879
Pianos, shifting action for, H. H. Northrop 416,800
Pipe coupling, E. G. Williams 417,127
Pipe coupling flanges, making, Van Wagenen & Graves 416,815
Pipe-holder, C. M. Danielson 416,908
Pipe or hose coupling, J. C. Sturgeon 417,114
Pipe wrench, J. A. Maloney 416,792
Pipes, automatic coupling for steam, J. Walker ... 416,767
Planter and cultivator, seed, I. G. Wise 416,884
Planter, seed, A. C. Evans 417,139
Plow, J. Brinkerhoff 416,989
Plow, hand, P. D. Graham 417,109
Plows, plant fender for, Parker & House 416,802
Pocket knife, J. V. Pilcher 416,946
Points, signals, etc., apparatus for locking and unlocking, S. T. Dutton 416,778
Post. See Fence post.
Pottery machine, W. L. Shepard 417,099
Power brake, L. P. Lawrence 417,194
Press. See Hay press. Printing press.
Printing machines, form roller mechanism for, S. Whitlock 416,929
Printing oil cloth in colors, machine for, W. H. Paine 417,089
Printing press, cylinder, B. Huber 416,786
Printing surfaces, preparation of, B. A. Brooks ... 417,142
Protector. See Pianoforte protector.
Puller. See Wad puller.
Pulley, W. R. Edelen 416,833
Pulley, carrying, A. McLean 416,943
Pump and measuring tank, oil, H. F. McKenzie ... 416,735
Pump governor, automatic, J. A. Steininger 417,113
Punch, check, S. M. Levy 416,929
Rack. See Clothes rack. Handle rack.
Railway block signals, electric danger alarm for, J. H. Hunter 417,188
Railway passenger service register, L. J. Carter ... 416,991
Railway signal, automatic, Greenwood & Jory 417,022
Railway switch, C. R. Dallenbach 417,156
Railway systems, system of supplying currents to electric, C. J. Van Depoele 417,122
Railway trains, protecting, J. I. Conklin 416,713
Railways, system of switching for conduit electric, C. J. Van Depoele 417,121
Rake, J. T. Thompson 416,763
Rake and tedder, combined, A. Isko 417,040
Ratchet twister, L. H. Yourtee 417,211
Rattlers or other machinery, mechanism for driving, C. A. Bauer 416,984
Reel. See Hose reel. Paper reel. Wire rod reeling reel.
Reel, J. E. Mandeville 417,060
Refrigerator, vacuum, B. N. J. Jacobs 416,788
Register. See Berth register. Railway passenger service register.
Regulator. See Feed regulator. Feed water regulator. Gas pressure regulator. Speed regulator.
Retort lid, F. C. Prindle 416,805
Rivets, etc., in jails, etc., means for concealing, W. S. Hull 416,787
Rock drill, J. F. Dittman 417,004
Roller mill, J. Dawson 416,904
Rolling mill, tire, J. Munton 416,797
Rolling mills, reeling mechanism for wire rod, C. H. Morgan 416,940
Rolling tires, J. Munton 416,798
Roofing, etc., plastic compound for, Livingston & Griscom, Jr 416,791
Rotary steam engine, C. V. Martin 417,193
Saddlers' stitching horses, attachment for, C. F. Shaw 416,865
Sash fastener, E. Horton 417,029
Sawmill dog, J. H. Miner 416,937
Sawmills, guard for circular, C. H. Stokes 417,204
Saw sharpening machine, E. B. Rich 416,748
Sawing machine, barrel head, J. A. Mumford 417,071
Sawing machines, brush attachment for, J. Robinson 417,090
Sawing machine, portable, W. D. Gunn 417,173
Scales, grain, C. H. Cootey 416,714
Scales, wagon, B. F. Stein 416,761
Screen. See Combination screen. Window screen.
Seat. See Carriage seat. Cart seat. Engineer's seat.
Secondary battery, C. H. Logan 417,055
Seeder, E. C. Tecktonius 417,115
Separator, G. A. Barnard 416,889
Sewing machine, R. Chandler 417,146
Sewing machines, wax thread, Cuming & Peirce, Jr 417,002
Sewing machines, cast-off for wax thread, J. H. Jacobs 416,841
Sewing machines, spring motor for, D. M. Pfauts. 417,081
Shade holder, E. W. Rice, Jr 416,745
Shades, machine for hemming and sewing fringe to, J. N. Wiggin 416,892
Shades to rollers, machine for securing window, J. N. Wiggin 416,891
Shears and conveyer, combined, Smith & Pottigrew 416,961
Sheller. See Corn sheller.
Shingle or roofing plate, metal, W. M. Norcross ... 416,851
Shoe stretcher, A. W. Cash 416,775
Show case, D. I. Keller 416,922
Shutter fastener, J. L. Cherot 416,902
Shutter fastener, F. Mesker 417,064
Sign, P. Knorpp 416,925
Signal. See Railway signal.
Signal rods, anti-friction guide for, J. T. Hambay 416,781
Signaling apparatus, train, S. T. Dutton 416,777
Slate cleaner and eraser, H. Rothermel 416,807
Slate frames, pencil holder for, J. O. Hebert 416,738
Smoke consumer, B. F. Fay 417,160
Soap and brush holder, W. P. Stott 416,962
Soldering iron heater, G. B. Snow 417,107
Spectacles, P. Peck 417,080
Speed gauge, O. Braun 416,996
Speed regulator, C. S. Tainter 416,969
Spirometer, coin-controlled, F. E. Robinson 416,850
Spokeshave, L. Camier 417,144
Spool holder, S. A. Cooney 417,151
Spring. See Doubletree spring. Torsion spring.
Stamp battery, M. P. Boss 416,898
Stand. See Beehive stand. Wash stand.
Steam engine, J. Cheek 416,900
Steam engine, D. Burns 416,823
Steam generator, R. Scott 416,957
Stereotype plate separating, trimming, and grooving machine, J. R. Cummings 416,716
Stirrup, E. M. Turner 416,768
Stopper. See Bottle stopper.
Store or shop fixture, M. H. Wilson 416,980
Stove attachment, vapor, J. G. Young, Jr 417,130
Stove grate, adjustable, H. W. Bodeman 417,208
Stovepipe thimble, J. L. Culberson 417,154
Stoves, burner for tops of, W. Vogel 416,878
Stoves, cleaning hot blast, F. W. Gordon 417,019
Stoves, water heating attachment for gas, J. H. McNutt 417,197
Strainer, G. W. Rush 416,932
Street receiver, T. Dark 416,830
Sugar, refining, F. Bauder 416,709
Surf power machine, H. E. Thomas 416,972
Switch. See Railway switch. Telephone switch.
Syringe, E. B. Wilder 416,977
Tag and tag fastener, P. Tremoulhere 416,813
Tank. See Flushing tank.
Telegraph transmitter, O. D. La Dow 416,732
Telephone exchange, house, W. M. Goodridge 417,018
Telephone switch, J. Suck 416,754
Telephone transmitter, J. C. Richmeyer 417,009
Tenoning machine, W. M. Pearce 417,200
Thermostat, W. P. Powers 416,947
Thermometer, A. P. Trotter 416,875
Thill couplings, anti-rattler for, W. P. Tracy 416,973
Thill couplings, anti-rattler spring for, W. E. Murbarger 417,072
Trashing machine, A. R. Gustafson 417,175
Thrashing machine straw carrier, R. R. Howell ... 416,785
Ticket holder, J. Geisenheimer 417,166
Torpedo, railway, J. H. Bevington 417,138
Torpedoes, firing mechanism for, A. Von Buonaccorsi di Pistoja 417,206
Torsion spring for vehicles, E. Jarrell 417,041
Toy or game, W. P. Lyle 417,058
Toys, vehicles, etc., guideway for traveling, J. E. Gause 417,015
Transom lifter, E. Hippard 417,182
Transplanter, Broadhead & Haines 416,808
Trap. See Fluid trap.
Trimmer. See Wall paper trimmer. Wick trimmer.
Trimming and slitting machine, J. B. Crosby 416,829
Trolley holder, W. F. Jenkins 416,920
Truck, brake, hand, R. D. Messinger 416,846
Truss, J. Perkins 416,739
Truss, G. Wilkinson 416,770
Tube or pipe machine, J. M. Riley 416,858
Tube skelps, machine for scarfing and bending, J. Hooven 416,731
Turntable, cable grip, C. Scholz 417,212
Turnstile, registering, J. Brady 417,141
Tuyere machine, N. Foust 417,164
Tuyeres, making, N. Foust 417,163
Type distributing machine, R. W. Nelson 417,074
Type setting machine, T. J. Lumis 417,057
Umbrella holder, G. A. Schoenike 416,755
Valve, J. H. Daly 417,008
Valve, Pratt & Robison 416,948
Valve, balanced slide, E. V. Thomas 416,812
Valve operating device for elevators, electro, C. W. Baldwin 417,132
Vaporizer, F. C. Hawkes 416,913
Vat. See Cheese vat.
Vehicle, S. P. Burdick 417,143
Vehicle running gear, H. M. Oliver 416,853
Vehicle standard, S. Graham 416,910
Vending machine, J. Corbett 416,828
Vending machine, coin controlled, J. Corbett 416,827
Vermin exterminator, poultry, E. Roop 416,961
Vest adjuster, D. W. Bergey 416,891
Violin, E. Gruenberg 416,726
Vise, W. G. Sheppard 416,959
Wad puller, M. A. Twitchell 416,975
Wagon seat lock, S. R. Lewis 416,930
Wall paper trimmer and straight edge, A. J. Gibson 417,167
Washou-out closet, porcelain, J. Reid 416,856
Wash stand, cabinet, F. H. Hungus 416,919
Watch case die, W. H. Fitz Gerald 416,835
Watch cases, device for manufacturing, F. Ecaubert 416,832
Watch lids, etc., mechanism for the manufacture of, F. Ecaubert 416,831
Water wheel, current, R. E. Gray 417,021
Weather strip, D. Hartley 417,178
Weather strip, M. Howard 417,184
Welding machine, electrical pipe or metal, H. E. Fowler 417,013
Wheel. See Paddle wheel. Water wheel.
Whip center, E. Ring 417,208
Wick trimmer, S. M. Houck 417,041
Winding mechanism, clamp collar for, J. Barrett. 417,133
Window, Anderson & Hull 416,772
Window screen, D. Hartley 417,179
Window screen, S. Roebuck 416,806
Wine, detecting coloring matter derived from coal tar in, Mathieu & Morfaux 416,794
Wire fabric, architectural, C. H. Cooper 416,826
Wire rod reeling reel, C. H. Morgan 416,941
Wood bending machine, B. Ludwig 417,056
Wood polishing machine, Osborn & Richards 416,801
Wrench. See Pipe wrench.

DESIGNS.

Bracelet, E. P. Beach 19,472
Button, C. D. Stone 19,481
Chatelaine bag, J. Henkel 19,479
Fence block, wire, Schwartzengraber & Bliss 19,483
Memorial cross, P. W. Bailey 19,471
Panel, ornamental, A. B. Cameron ..... 19,473 to 19,478
Weeding hook, S. Palmer 19,480

TRADE MARKS.

Blocks, sets or series of picture, P. Cox 17,255
Buttons, cuff and collar, F. I. Marcy & Co 17,309
Cotton sheetings and shirtings, Jackson Company, 17,251, 17,252, 17,261
Dyspepsia remedies, H. D. Hughes et al 17,250
Food, birds', Snook & Halbe 17,260
Grease, lubricating, wool, and other oils, machinery, Columbia Refining Co 17,248
Hair tonic, tooth powder, and toilet powder, G. W. Kirk 17,265
Leather goods, fancy, V. Le Brun 17,266
Medicine for the cure of rheumatism, neuralgia, and like diseases, M. Rennie 17,273
Medicine for the removal of the effects of over-indulgence in drink, R. J. Philippi 17,271
Oils, lubricating, G. C. Field 17,249
Paints ready for use, liquid, A. Stengel 17,269
Perfumes, R. W. Gardner 17,262
Perfumes, Lehn & Fink 17,267
Photographic developing and fixing baths, nonactinic substances for use in, Spiro & Smadbeck 17,257
Polish, stove, F. W. Anderson 17,247
Polish, stove, W. J. Rigby 17,256
Sheetings and shirtings, Jackson Company 17,264
Shingles, metallic, National Sheet Metal Roofing Company 17,254
Smokers' use, certain named articles for, Langfelder & Hammerschlag 17,245
Stoves, furnaces, and their various parts, cooking and heating, Michigan Stove Company 16,269
Water wheels and water motors, Pelton Water Wheel Company 17,270
Whisky, G. Clark & Co 17,263
Whisky, Stoll, Vannatta & Co 17,258

A Printed copy of the specification and drawing of any patent in the foregoing list will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated, the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

INDEX.

ILLUSTRATIONS.

A

Aberdeen City 111
Air purifier, Benson's 322
Air ship, Campbell 47
Alarm, burglar 4
Alarm, door, electric 275
Alarm, elevator 150
Alarm, high and low water 211
Alaska, ship 393
Americas, map of the 336
Andromeda nebula 54
Annealing box 34
Apron, carriage 194
Apparatus, air cooling 402
Arc lamp, Carson 154
Arch, Washington 6
Armor, war ship 404
Ash pan cleaner 322
Ash sifter, Crosby's 210
Ash sifter, Love's 82, 147
Augusta Victoria, ship 393

B

Backband hook 195
Balloon, Campbell 47
Baltimore, cruiser 36
Band cutter, Cook's 211
Bars, manufacture of 99
Bass, hard-scaled 265
Battery cells, arrangement 253
Battery, dry, Gassner's 306
Battery, a powerful 135
Battery, secondary 22
Beams, lock joint for 178
Beaver, the 371
Bearing, propeller shaft 82
Belt lacing, Bristol 117
Belting, leather 6
Bending machine, pipe 130
Bending rolls, large 213
Bicycle engine 150
Bicycle, military 343
Bird, an extinct 290
Biscuit cutter, Sidway's 325
Blacking box, improved 179
Blast heater, Scanlon's 226
Boat, torpedo 222
Boiler, Davidson's 178
Boiler explosion at Bucyrus 329
Boiler, wash, Tarr's 30
Bolt, door, improved 242
Boot heel, Strasser's 307
Bottle protector, Keitow's 323
Bracket, lamp, piano 4
Brick mould, Paul's 354
Bridal Veil Falls 1
Bridge, English Channel 342
Bridge, Wheatstone's 249
Bridges, rolling, electric 130
Buckle, locking, Blum's 96
Burglar alarm 4

C

Cactus, a mammoth 359
Calipers, carpenter's 178
Can, oil, Rau's 163
Canal, Manchester 287
Canal, miniature 358
Candle, electric 115
Car for carrying stones 195
Car door, improved 242
Car, dumping 386
Car dumping device 370
Car, dumping, improved 162
Car, sanding device for 370
Cars, unloading device 370
Carriage, electric 51
Carrier, paper, automatic 402
Cart road, improved 162
Casks, glass-enameled 255
Castor fiber 371
Cave, Mammoth 247
Chain, drive, Jennings' 323
Chair for sea beach 18
Chimney cover, Lhote's 387
City of Paris, ship 393
City of Rome, ship 393
Clevis arm for ice plows 276
Clutch, friction, Denton's 403
Coal washer and separator 322
Cock, blow-off 162
Coco de mer 105
Cocoanut parer 194
Cohesion, demonstration of 393
Coiling machine for pipes 130
Condor, cruiser 199
Conveyors, pneumatic 295
Cook, George H 265
Coop, hen, improved 114
Cotton cultivator, Runyon's 276
Coupling jack, thill 114
Coupling, thill, Barr's 291
Coupling, thill, Lee's 5
Crane, ten-ton 311
Crane, traveling, Trubia 403
Cruiser, 1,000 ton 19
Cruiser Baltimore 36
Cruiser Condor 199
Cruiser Maine 212
Cruiser Philadelphia 85, 164
Cultivator, Benthall's 67
Cultivater, cotton 276
Cultivator, Schoolbred's 67
Currents, artificial 258
Curtain ring attachment 387
Cut-off, rain water 402

D

Dam, portable 354
Dam, Sodom 103
Deflingator, Wade's 226
Dentistry, operative 98
Die, screw-threading 323
Dish drier, Wilson 338
Ditcher, tile 118
Dock, dry, new 341
Door bolt, improved 242
Door, freight car 243
Draught equalizer 18
Drawbridge gate 162
Drill, stone, Ingersoll 99
Drum, side, Johnston's 338
Dumping device, car 370
Dunning, Wm. B 243
Dwelling, attractive 167
Dynamo, Edison 274
Dynamo, electro-plating 213
Dynamo, multipolar drum 259

E

Edison, Thomas A 230
Egg, experiments with 72
Eiffel tower, first gallery 183
Electric battery, powerful 135
Electric candle 115
Electric door alarm 275
Electric lamp, Carson's 154
Electric lamp hanger 51
Electric propulsion 51
Electric rolling bridges 130
Electric tachyscope 305
Electro-plating dynamo 213
Elevator alarm 150
Engine, bicycle, Boynton 150
Engine, gas, Otto 227
Engine governor, Agee's 147
Engine, stationary, exhibits 182
Engine, steam, Straub's 23
Engine, Willard 280
Eraser, ink, Johnston's 84
Etruria, ship 393
Eyepiece, astigmatic 131
Exhaust pipe, locomotive 291
Exhibition, maritime, Boston 358
Experiments, scientific, simple 72
Explosion, boiler, at Bucyrus 329
Exposition, floating, German 273
Extinguisher, lamp, Paige's 306

F

Falls, Bridal Veil 1
Falls, Multnomah 392
Feed water heater 99
Fence, Barton's 34
Fence, Macrea's 72
Fender for car windows 5
Fertilizer distributer 67, 370
Fire escape, Lennier's 338
Fire extinguisher, Mitchell's 163
Fireplace and heater 306
Fish, poison, Indian Ocean 406
Floor beam connection 99
Foor jack, Dix's 258
Food products, palace of 102
Foot rest for radiators 18
Fountain, luminous, table 346
Fountains, luminous 376
Frog, nest building 39
Frog, replacing 226
Fruit picker, Brasee's 178
Fuel gas generator 195
Fuel, poor, utilization 390
Furnace for poor fuel 390
Furnace hearth 135

G

Galvanometer, tangent 181
Game of brax 147
Gas engine, Otto 227
Gas, fuel, generator 195
Gas, an unknown 358
Gate, drawing 162
Gate hinge 354
Gear cutting machine 35
Gear, running, vehicle 275
Gearing, frictional, Evans' 210
Girard, Mr., inventor 327
Glass blowing, hints on 50
Glass perforating 70
Globe holder 35
Grain, heating and steaming 6
Grindstone tool holder 18
Gold beating 167
Governor, Agee's 147
Governor, engine, Brown's 194

H

Hand exerciser, Bidwell's 210
Handle for pans 24
Hanger, electric lamp 51
Harness, Gray's 51
Harness hook, Nolley's 195
Harness, safety 114
Hawser, a large 358
Hearth, furnace 195
Heat 340
Heater, blast, Scanlon's 226
Heater, feed water 99
Heel, boot and shoe 307
Hencoop, improved 114
Hinge, gate 354
Hoop snake 344
House, cheap 167
Hydrobarometer, tele 66

I

Ice, contraction 4
Ice machine, Dermigny's 289
Illusion, optical 386
Image, Nampa 292
Induction machine 294
Ink eraser, Johnston's 84
Iron, crude, into steel 99

J

Jack, floor, Dix's 258
Jack, lifting, Smith's 72
Jack, thill coupling 114
Jacob's ladder 277
Jupiter, occultation 277

K

Keyhole guard 195
Knife, pocket, Brede's 84

L

Lacing, belt, Bristol 117
Ladder, Jacob's 277
Lamp, arc, new 154
Lamp, Bissell's 210
Lamp bracket, piano 4
Lamp, Edison 274
Lamp, electric, hanger for 51
Lamp extinguisher, automatic 291
Lamp extinguisher, Paige's 306
Lantern, scientific 115
Lathe, dog, Esgert's 275
Lathe, Fox, French 202
Launch, Naphtha 358
Leather stretcher 6
Leg, artificial 179
Lens, photographic 114
Leverrier, statue of 100
Lighting, incandescent 274
Lightning flash 70
Lightning rod, new 131
Lock, Douglass 290
Lock joint for beams 178
Lock, Neubrand's 82
Lock, railway switch 163
Locomotive, bicycle 150
Locomotive exhibits, Paris 66
Loomis, Elias 146
Lumber center, great 111

M

Maine, cruiser 212
Manometer, tele 63
Map of the Americas 336
Meat-carrying apparatus 275
Mendenhall, Prof. T. C 136
Microscope for lantern 115
Mines, salt, Retsof 71
Mirror, astronomical 147
Mitchell, Maria 358
Mixer, Broughton 338
Molecular actions 390
Motor, steam, Straub's 23
Motor, water, Bessemer's 236
Mould, brick, Paul's 354
Mount Stephen 215
Movement, mechanical 34
Mt. Hood, views on 66
Mucilage bottle, new 6
Music leaf turner 179
Music regist. by phonograph 290

N

Navy, French, types of 199
Navy, new, additions to 19
Nebulæ, discoveries in 54
Necktie, improved 51
Needham, Elias Parkman 401
Nitrate of soda, Chilean 407

O

Oilcan, Rau's 163
Oiler, spring cover 5
Ore, separator, Thomas' 35
Organ pallet, Girardin's 330
Oyster pail, new 20

P

Packing, piston rod 114
Paddle wheel, new 342
Pail, oyster, new 20
Palace of food products 102
Pan holder, Egan's 179
Pendant, watch case 307
Peters, Norvis 146
Philadelphia, cruiser 85, 164
Phonograph, listening to 231
Photography, feat in 372
Pipe bending machine 130
Pipe, empty, smoking 72
Pipe, exhaust 291
Piston rod packing 114
Planter, seed, new 67
Planter, Tragethon's 243
Pleiades, chart of 55
Pneumatic conveyer 258
Pneumatic tube, Johnson 239
Polariscope, lantern 115
Press, baling 67
Price indicator for scales 211
Printing machine, web 314
Projectiles, photographing 372
Propeller-shaft bearing 82
Propulsion, electric 51
Protector for wall paper 72
Protractor, Dufield's 84

R

Rabbit drive, California 295
Radiators, foot rest for 18
Railroad, Housatonic, accident 24
Rails, manufacture of 99
Railway car, Treanor's 195
Railway, Mount Pilatus 319
Railway, sliding, Girard's 327
Razor strop, Ray's 323
Refrigerators, Hill's 307
Reservoir, Sodom 103
Resistance column 163
Resistance, measurement 249
Respiragraph, Tata's 131
Rheostat column 163
Rifle, Remington-Lee 211
Roofing tank apparatus 162
Rule, carpenter's 178
Rutherfurd, Lewis M 375

S

Salt mines, Retsof 71
Sanding-device, car 370
Sandpapering machine 322
Sash holder, new 18
Saw, drag, improved 290
Sawing machine, De Graff's 290
Scaffold standard 291
Schools, technical, French 83
Scissors attachment 226
Screen, window 387
Screw driver and wrench 275
Screw driver, Teubner's 387
Screw threading die 323
Seed drill, Genung's 370
Seed planter, improved 67
Separator, ore 35
Sewing machine 6
Seychelles Islands 217
Shield for firemen 307
Ship, air, Campbell 47
Ship canal, Manchester 287
Ships, passenger, Atlantic 389
Shoe heel, Strasser's 307
Shutter device, Jorres' 213
Sieve, thrashing machine 5
Sifter, ash, Crosby's 210
Sifter, ash, Love's 82, 147
Signal Service station, N. Y 277
Signal, railway, electric 402
Sill plate for cars 194
Siphon, Meyer's 131
Sleds, propelling 132
Smoke consumer, Force's 195
Snake, hoop 344
Spark conductor, Brandt's 82
Spiders, maternal instinct 25
Spider, poisonous 217
Spider, web making 242
Spindle wharve 242
Stair climber, Amiot's 386
Stamp mill, Krause's 323
Stanley, H. M 391
Statue of Leverrier 100
Steam boiler, Davidson's 178
Steam engine governor 194
Steamer Teutonic 117
Stirrup, safety 132
Stone drill, Ingersoll 99
Stone, moving, Buenos Ayres 360
Storm apron 194
Swing, child's 5
Switch lock, railway 163
Switch, railroad, Wolfe's 258
Synchronism, visual, in teleg 399, 405

T

Tachyscope, electric 305
Teeth filling 98
Telegraphy, rapid, new sys 399, 405
Telemeter system 63
Telephone, a simple 374
Teutonic, ship 393
Teutonic, steamer 117
Thermometer, clinical 131
Thermometer, metallic 340
Thermometer, tele 63
Thermostat 340
Thill coupling, Barr's 291
Thill coupling, Lee's 5
Thill coupling jack 114
Ticket case, Hart's 370
Tie, rail, Jones' 402
Tiger, saber toothed 393
Tile ditcher 118
Tool holder, grindstone 18
Tool, pneumatic, MacCoy 134
Torpedo, Halpin-Savage 223
Torpedo, Sims-Edison 21
Tower, Eiffel 166
Tower, Eiffel, first gallery 183
Trees, felling, device for 387
Tripod, sketching 226
Tube, pneumatic 239
Tubes, glass, to bend 50
Tunnel, Hudson River 143
Type writer, Victor 197
Type writers, attachment for 339

U

Umbrella stand 98
Unloading device, car 370

V

Vacuum apparatus, mouth 264
Valve head, Morris 178
Valve for steam engines 50
Vari in Berlin Garden 9
Vehicle, two-wheeled 179
Velocipedist, military 343
Ventilator, window 147
Violin tail piece 338

W

Wall paper protector 72
Washboard protector 291
Washing machine, Johnsen's 34
Watch case pendant 307
Water inexpansibility of 4
Water motor, Bessemer's 258
Water wheel, Adams' 213
Water works, Chicago 367
Wave power, utilizing 191
Wharve, spindle 242
Wheel, gear, worm 242
Wheel, paddle, improved 342
Wheel, water, Adams' 213
Window sash, swinging 226
Window screen, Greve's 387
Wire screw machine 6
Window ventilator 147
Woodcock, the 198

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

A

Aberdeen City *111
Acid, carbonic, in phthisis 226
Accidents from electricity 403
Air, compressed, as motive power 144
Air purifier, Benson's *322
Air ship, Campbell *47
Alarm, burglar *4
Alarm, door, electric *275
Alarm, elevator *150
Alarm, high and low water *211
Alcohol, effects of 306
Alcoholism, crime and insanity 228
Alcoholism in Norway 277
Alloy, new 229, 313
Alum in bread 229
Aluminum 164, 167
Aluminum, reduction of 66
Amber 56
Amber and ambergris 281
American abroad 135
American Assoc. Adv Sci 160, 164, 176
American Institute fair 136, 225, 288, 313
Americas, three, congress of 324
Ammonia as antiseptic 38
Andromeda nebula *54
Animals, medium size 301
Animals, sociability of 229
Annealing box *34
Anthrax albumose 360
Antimony, Arkansas 306
Antiseptic, ammonia as 38
Antiseptic, new 372
Ants, red 37
Apron, carriage *194
Apparatus, air cooling *402
Appliances, railway 408
Arc lamp, Carson's *164
Arch, Washington *8
Arms and powder, new 116
Art, Japanese 293
Artillery tactics, German 80
Arrow poison 4
Ash pan cleaner *322
Ash sifter, Love's *82, *147
Ash sifter, Crosby's *210
Association, American 112
Awards at Paris Exposition 273

B

Bacilli 84
Backband hook *196
Balloon, Campbell *47
Balloonists, experience of 8
Balloons, natural gas for 165, 229
Baltimore, cruiser *36, 192
Baltimore, power and speed of 258
Band cutter, Cook's *211
Bargains, making 200
Bark dust explosion 118
Barnacles 217
Bars, manufacture of *99
Basins, fresh water 273
Bass, hard scaled *265
Bath, tempering, great 241
Bath, toning 7
Baths, free, Milwaukee 198
Bathing season, warning for 100
Battery boxes, tight 198
Battery cells, arrangement *253
Battery, dry, Gassner's *306
Battery, gas, new 20
Battery, a powerful *135
Battery, secondary *22
Battery, secondary, substitutions 112
Battery, storage, street car 162
Beams, lock joint for *178
Beaver, the *371
Bearing, propeller shaft *82
Bearings, journal, roller 201
Beet sugar 51
Beet sugar, California 229, 309
Beet sugar, progress of 169
Belt lacing, Bristol *117
Beetle, tiger, larvæ of 102
Belting, leather, improved *6
Bending machine, pipe *130
Bending rolls, large 213
Bibles, to be seven 221
Bicycle engine *150
Bicycle, military *343
Bird, bower 201
Bird, extinct *290
Birds, Canary, to change color 58
Biscuit cutter, Sidway's *323
Blacking box, improved *179
Blake, war ship 198
Blast heater, Scanlon's *226
Blasts, great 261
Blisters in albumen prints 165
Board of health notes 82
Boat, jet, evolution 160
Boat, torpedo *223
Boat, torpedo, designing 32
Boats, torpedo, hot decks in 104
Boats, torpedo, new 178
Boiler, Davidson's *178
Boiler explosion at Bucyrus *329
Boiler incrustations 165
Boiler incrustation, sugar in 53
Boiler, wash, Tarr's *30
Boilers, weight and power of 133
Bolt, door, improved *242
Book, our new 337
Books and publications, new 409
Boot heel, Strasser's *307
Borax, California 84
Bottle protector, Keitow's *323
Boulak Museum 105
Bracket, lamp, piano *4
Brain weight, man and woman 289
Bran, compressed 89
Branding cattle 58
Brazil, United States of 356
Bread, alum in 229
Bread bakery, large 117
Bread trust, London 290
Brewing, chemistry of 397
Brick kilns 241
Brick mould, Paul's *354
Bridal Veil Falls *1
Bridge, Cairo, opened 289
Bridge, English Channel 256, 342
Bridge, Forth 306
Bridge, New London, opening of 240
Bridge, Wheatstone's *249
Bridges, American 261
Bridges, rolling, electric *130
Bridgman, Laura 36
Brown-Sequard's experiments 80
Buckle, locking, Blum's *96
Burglar alarm *4
Business success 52, 195
Butterflies, yellow pigment 147
Buttermilk sep. from butter 262
Buttons, horn, iridescent 89

C

Cactus, a mammoth *359
Calamity, prophesying 82
California, irrigation of 259
Calipers, carpenter's *178
Camphor compounds 196
Can, oil, Rau's *163
Canal Co., Nicaragua 294
Canal, irrigation, California 325
Canal of Joseph 39
Canal, Manchester *287
Canal, miniature *358
Canal, Nicaragua 354
Canal, Panama 329
Canal, San Blas route 81
Candle, electric *115
Candles, peat 313
Cane sugar 55
Capital, English vs. American 214
Capitalists and inventors 321
Car company, Pullman 329
Car door, improved *242
Car, dumping *386
Car dumping device *370
Car, dumping, improved *162
Car, an exhibition 325
Car lamp, electric 169
Car wheels, boring 343
Car for wide stones *195
Cars, sanding device for *370
Cars, unloading device *370
Carbo-dynamite 66
Carbuncle, treatment of 392
Carcass, animal, all utilized 278
Carrier, paper, automatic *403
Carriage, electric *51
Carriage, steam 69
Cart, road, improved *162
Carvings, wood, imitation 35
Casks, glass enameled *255
Castor fiber *371
Catalogue, American 102
Catarrh 38
Caterpillars, migrations of 229
Cattle, branding 58
Cave, mammoth *247
Celluloid 120
Cellulose, colloidal 359
Cement for iron and stone 195
Cement, test for 97
Cement, useful 308
Centenarian, remarkable 92
Chain, drive, Jenning's *323
Chair for sea beach *18
Charleston, steamer, trial 199
Chimney cover, Lhote's *387
Chimney, the tallest yet 372
China, thoughts about 337
Chinese, the insulted 193
Chloralamide 360
Chloralamide, new hypnotic 196
Chloroform, patents under 85
Chrome iron on Pacific 85
Chronometer improvements 263
Cider, fermentation of 181
Cigarette doomed 132
Cinnamon trade, Ceylon 260
Clark, Sir Andrew 232
Clevis arm for ice plows *276
Clothing, tight, effects of 149
Clothing, worn, restoring 85
Clutch, friction, Denton's *403
Coal dust, utilization of 353
Coal, large block of 151
Coal mining at Cape Breton 49
Coal washer and separator *322
Cocaine, crude 308
Cock, blow-off *162
Coco de mer *105
Cocoanut parer, Lewis' *194
Coffee in liver disease 213
Cohesion, experiments on *260
Coiling machine for pipes *130
Cold, production of 21
Colds, prevention of 276
Colors, beautiful, sources of 183
Columbia River, jetty works 23
Combustion, spon., cotton bales 404
Commerce, our foreign 137
Commerce, to promote 344
Comet, Brooks, new 37
Comets, cluster of 151
Condor, cruiser *199
Confectioner, disease of 329
Conference, marine, international 272
Contracts, government 144
Conveyers, pneumatic *258
Cook, Prof. George H 212, *265
Cooking by electricity 321
Coop, hen, improved *114
Copper mines, Sudbury 308
Cotton bales, articles in 344
Cotton bales, spon. combus 404
Cotton cultivator, Runyon's *276
Cotton manufacture, Brazil 164
Cotton mill life, India 206
Couplers, automatic 49
Coupling bar, Chisholm's *323
Coupling jack, thill *114
Coupling, thill, Barr's *291
Coupling, thill, Lee's *5
Crane, ten ton *311
Crane, traveling, Trubia *406
Croton reservoirs *103
Cruiser, 1,000 ton *19
Cruiser Baltimore *36, 192
Cruiser Philadelphia *85, *164
Cruiser Condor *199
Cruiser Maine *212
Cruiser Yorktown 386
Cuffs, collars and shirts 129
Cultivator, Benthall's *67
Cultivator, cotton, Runyon's *276
Cultivator, Schoolbred's *67
Current, alternating, deadly 106
Currents, artificial *258
Currents, electric 4
Currents, high tension 364
Curtain ring attachment *387
Cut-off, rain water *402

D

Dam, portable, Summer's *354
Dam, Sodom *103
Dams, bursting, in geology 7
Deafness of old age 168
Death, what produces 292
Degrees, honorary 281
Delineator, Wade's *226
Delirium furiosum 227
Dentistry in 1796 69
Dentistry, operative *98
Derrick, electric force in 162
Designs in Great Britain 46
Designs in houses 198
Developer, photo., a new 177
Developer, pyro 353
Developer, pyrocatechine 165
Developing by white light 216
Diamond 98, 276
Diamonds, artificial 221
Diamonds at the exposition 277
Diamonds, making 72
Dickerson, Edward N 385
Die, screw-threading *323
Dipsomania 344
Dish drier, Wilson's *338
Ditcher, tile *118
Divining rod 342
Dock, dry, new *341
Dock, dry, Norfolk 248
Doctor, how a great won his way 252
Dog, railroad 220
Dogs, use of in war 66
Donkin, Mr., sad fate 109
Door bolt, improved *242
Door, freight car *242
Dough mixer, Stone's *305
Dragon tree, the great 56
Dragon tree, large 312
Draught equalizer *18
Drawbridge gate *162
Drawings, copying 132
Dredge, Bowers, at Tacoma 7
Dredger, Bowers 85
Drill, stone, Ingersoll *99
Drug trade 40 years ago 87
Drum side, Johnston's *338
Dunning, Wm. B *243
Dwelling, attractive *167
Dynamite, carbo 86
Dynamite gun, trial of 259
Dynamo, Edison *274
Dynamo, electro-plating *213
Dynamo, multipolar drum *259

E

Eburneum process 328
Eclipse of sun 216
Edison anticipated 229
Edison, home life of 51
Edison, honors to 144
Edison, Thos. Alva *230
Edison, what he saw abroad 349
Educators, internat. assoc 289
Eel skin for rheumatism 182
Egg, nourishment in 41
Eggs, colors of 312
Eggs, experiments with *72
Egypt, discoveries in 169
Egypt exploration fund 9
Eiffel tower *166, 178
Eiffel tower, first gallery *183
Eiffel tower, meteorology 33
Eiffel tower struck by lightning *64
Eiffel tower, visit to 149
Eikonogen, a new developer 177
Electric battery, powerful *135
Electric candle *115
Electric car lamp 169
Electric Co., Brush 344
Electric Co., Westinghouse 311
Electric currents 4
Electric door alarm *275
Electric execution of criminals 340
Electric force in a derrick 162
Electric influence machine 130
Electric lamp, Carson *164
Electric lamp hanger *51
Electric lamp patent 340
Electric light association 184
Electric light companies 341
Electric light, fishing with 198
Electric light linemen 34
Electric lighting suit 7
Electric propulsion for roads 51
Electric railway, mountain 54
Electric railways 184
Electric rolling bridges *130
Electric search light 96
Electric subway explosions 113
Electric tachyscope *305
Electric traction increaser 177
Electric trench nuisance 179
Electric welding 329
Electrical 404
Electricity, accidents from 403
Electricity, antics of 132
Electricity better than sand 307
Electricity, cooking by 121
Electricity, execution by 65
Electricity in the United States 150
Electricity on war ships 9
Electricity, work of 104
Electro-plating dynamo *213
Elephant, a noted 307
Elevator alarm *150
Elevator, cheap 80
Elevator, Otis, trial of 2
Elevators, liability carriers 257
Encaustic process, Egyptian 18
End, what will it be? 6
Endorsing 248
Engine, bicycle, Boynton *150
Engine, condensing, Willard *280
Engine, gas, Otto *227
Engine governor, Agee's *147
Engine, stationary, exhibits 118, *153, *182
Engine, steam, Straub's *23
Engineers, American, abroad 50
Engineers, American, in England 16
Engineers', American, trip 244
Engineers, American, visit of 20
Engineer, professional 208
Engineers, Prussian 245
Engineers, why they should study 7
Ensilage, fermentation 290
Epidemic influenza 400
Entomologist, honors to 132
Eraser, ink, Johnston's *84
Ericsson's physical strength 388
Etching, zinc 36
Evolution, jet boat 160
Execution, electric, of criminals 240
Exhaust pipe, locomotive *291
Exhibition, American, 1892 356
Exhibition, electric, Edinburgh 387
Exhibition, maritime 388, 304
Exhibition, maritime, Boston *358
Exhibition, Paris, 5, 17, 40, 52, *97, *98, 99, *68, 97, *102, 113, *137, *153, *169, *182, 193, 207, 241, *262, 277, *279, 325, 328, *376
Expedition, astronomical 256
Experiment, search light 96
Experiments, Brown-Sequard's 80
Experiments, scientific, simple 72
Explosion, bark dust 118
Explosion, Bucyrus *329
Explosions in elect. subways 112
Explosion, fire-place 33
Explosions, subway 390
Explosive, new 289
Explosive, new, grakrut 312
Exposition of 1892 ..... 64, 126
Exposition, floating, Germany *273
Exposition, Paris, cost of 325
Extinguisher, lamp, Paige's *306
Extralite, explosive 390
Eyepiece, astigmatic *131

F

Fair, American Institute 136, 225, 288, 313
Falls, Bridal Veil *1
Falls, Multnomah *338
Falls, Niagara, utilizing 370
Farms, vacant, Vermont 281
Farming, frog 400
Fasoldt, Charles 39
Feed water heater *69
Fence, Barton's *24
Fence, Macrea's *73
Fender for car windows *5
Fertilizer, distributer *87, *370
Fever, typhoid 165, 215
Figures, wax, how made 404
Fever, yellow, germ of 280
Film, transparent, new 7
Finish, dead, simple 246
Fir, green 361
Fir, green, burning of 196
Fir stronger than oak 86
Fire escape, Lennier's *308
Fire escapes, uninflammable 150
Fire extinguisher, Michell's *162
Fireplace explosion 38
Fireplace and heater *306
Fire, railroad, singular 178
Fire, what is a 24
Fires at Lynn and Boston 352
Fires, safeguards against 320
Fish, blind 51
Fish, iced, dangerous 249
Fish, poison, Indian Ocean *408
Fishing with electric light 198
Fishes, speed of 201
Flames, radiating power 104
Fleet, merchant, plea for 252
Floor beam connection *89
Floor, good, to make 9
Floor jack, Dix's *258
Floors, how to lay 65
Flour moth 392
Flour production, facts about 7
Flour, water in 310
Flowers, blue, fading of 295
Flume, San Diego 70
Fluorite 86
Food products, investigation 296
Food products, palace of *102
Foods, germs in 229
Foot rest for radiators *18
Forbes, Capt. R. B. 309
Forest, giants of the 330
Fossils in Oregon 309
Fountains, luminous *376
Fountains, luminous, table *246
Freeman, Stephen 307
Frog farming 400
Frisbie, D. 144
Frog, nest building *39
Frog, replacing *226
Fruit candying industry 39
Fruit drying 232
Fruit picker, Brazee's *178
Fuel gas generator *196
Fuel, power, utilization *229
Furnace for poor fuel *389
Furnace hearth *195

G

Galvanometer, tangent *161, 309
Game of brax *147
Garbage consumer 182
Gardens, floating, Chinese 309
Garden, zoological, national 6
Gas battery, new form of 39
Gas, carbonic acid, liquefied 68
Gas engine, Otto *127
Gas at five cents a thousand 281
Gas, fuel, generator *196
Gas invention, new 373
Gas kiln for fire bricks 275
Gas, natural 86, 146
Gas, natural, for balloons 186, 229
Gas, natural, decline of 340
Gas, natural, under Lake Erie 342
Gas, natural, Salem 309
Gas, natural, Utah 321
Gas, natural, Welland 356
Gas, natural, Wheeling 309
Gas plant, ruin of 198
Gas, purification of 308
Gas at Sandy Creek 179
Gas, an unknown 309
Gas well, a deep 255
Gate, drawbridge *162
Gate hinge *354
Gear cutting machine *85
Gear, running, vehicle *275
Gearing, frictional, Evans' *210
Geological society, American 309
Geological Society, meeting 168
Germination, effect, electric 56
Giants of the forest 330
Glass blowing, hints on *39
Glass, how to perforate *70
Glass, plate, casting 84
Glass, silvering 51
Glass, substitute for 190
Globe holder *86
Glue for glass (971) 10
Gold beating *87
Gold discoveries, African 349
Gold for 1888 86
Government statistics 84
Governor, Agee's *147
Governor, engine, Brown's *194
Grader, road, Chambers' *323
Grain, heating and steaming *6
Grakrut, explosive 312
Graphophone in medicine 280
Grindstone tool holder *18
Grub, rabbit 138, 181
Guinea, explorations in 309
Gum, chewing (1146) 107
Gun, a 12-mile 181
Gun, 36-pounder 144
Gun, dynamite, trial of 229
Guns, Maxim, trial of 69
Gun, a new 134
Gun, 110 ton, bending 404
Guns, cast steel 118
Guns, Spanish, new *185

H

Habit, regularity of 89
Hand exerciser, Bidwell's *210
Hands, let your mind aid 344
Handle for pans *84
Hanger, electric lamp *51
Harness, Gray's *51
Harness hook, Nolley's *196
Harness, safety *114
Hasheesh smoker, dreams 5
Hawser, a large *308
Head and heart, aches of 88
Head, pains in the 277
Health Association, American 308
Health and spirits 363
Heart disease 249
Heart failure 56, 105
Hearth furnace *195
Heat *340
Heat, loss in steam pipes 41
Heater, blast, Scanlon's *226
Heater, feed water *69
Heel for boots and shoes *307
Hen coop, improved *114
Hinge, gate *354
Hint, a sensible 197
Hoop snake *344
Horn snake myth 114
Horse, sense of smell in 69
Horses, food and care of 320
Hose pipes, notes on 53
Hot Water Co., Boston 397
House, dwelling, cheap *107
House building at West 369
Housetops as playground 245
Hudson River illuminated 249
Hydrobarometer, tele *68
Hydrogen, peroxide 201
Hypnotic, a new 196
Hypodermic method 353
Hymenomycetes, species of 56

I

Ice, contraction of *4
Ice machine, Dermigny's *339
Ice in the sickroom 179
Influenza, epidemic 401
Ice water, is it healthy? 65
Illusion, optical *328
Image, Nampa *393
India rubber 179
India rubber in carriage 392
Induction machine *394
Injector, waste of the 180
Ink eraser, Johnston's *84
Ink stains 118
Ink, typewriter 293
Ink for writing on photos 165
Insanity, causes of 181
Insects, heat developed by 201
Insects, vision in 56
Institute, Pratt 401
Invention, gas, new 373
Invention, progress of 310
Invention wanted 304
Inventors and capitalists 321
Inventions, Chinese 52
Inventions, retarding of 3
Inventions recently patented 10, 26, 42, 58, 73, 90, 106, 122, 138, 154, 170, 186, 202, 218, 234, 250, 266, 282, 297, 314, 330, 345, 360, 378, 393, 409
Inventions and wages 231
Iron, chromic, in Pacific 85
Iron, corrosion of 86
Iron, crude, into steel *99
Iron ore, Pilot Knob 119
Iron pipes, rusting of 137
Iron, silvering 17
Iron and steel institute 248
Irrigation in California 289

J

Jack, coupling, thill *114
Jack, floor, Dix's *258
Jack, lifting, Smith's *72
Jacob's ladder *227
Japanese in China 341
Jaw, necrosis of 291
Jetty work, Columbia River 82
Joint-making material, new 98
Joule, James P. 288, 321
Jupiter, occultation of *277
Jupiter, scenes on 298

K

Key-hole guard *195
Kidney disease, coffee in 46
Kilns, brick 241
Kiln, gas, for bricks 275
Knife, pocket, Brede's *84
Knowledge, working for 64

L

Laborers, German, care of 312
Laborers' laws, new 66
Lacing, belt, Bristol *117
Lacquer, Japanese 343
Ladder, Jacob's *227
Lake Shore drive 20
Lamp, arc, new *164
Lamp, Bissell's *210
Lamp bracket, piano *4
Lamp, car, electric 169
Lamp, Edison *274
Lamp, electric, hanger for *51
Lamp extinguisher, Miller's *291
Lamp extinguisher, Paige's *306
Lamp, incandes., patent 240
Lamp lighter, clockwork 309
Lamp, semi-incandescent 197
Lamps, petroleum management 279
Language, Spanish 316
Lantern, scientific *115
Lathe attachment, Cole's *354
Lathe dog, Engert's *275
Lathe, Fox, French *262
Lathes, French, English and American 3
Launch, naphtha *358
Law, contract, foreign 229
Law, foreign contract, a nullity 329
Laws, labor, new 66
Lead, white, factory 197
Leaf printing 308
League, Scripps, in England 148
Leather stretching machine *6
Leaves, oak, shape of 384
Left leggedness 384
Leg, artificial *179
Lemon cultivation, Sicily 81
Lens, photographic *114
Lenses, spectacle 201
Lepidoptera, bleaching 56
Leverrier, statue of *100
Life, animal, increase of 312
Life insurance 167
Light, loss through windows 84
Light, penetration in water 274
Light, phenomenon of 346
Light, search, experiment 98
Light in the sick room 145
Lighthouses, American 289
Lighting, incandescent *274
Lightning flash *70
Lightning flashes, photos 113
Lightning, protection from *131
Limited, word, meaning of 56
Line, American, to Europe 48
Lineman, danger to 34
Linen? shall we make 25
Liver disease, coffee in 46
Liver, hydatid cyst of 384
Lock, Douglass' *389
Lock joint for beams *178
Lock, Neubrand's *82
Lock, railway switch *163
Locomotive, bicycle *130
Locomotive exhibits, Paris *69
Locomotive, hot water 392
Locomotive struck by lightning 22
Locomotives, Baldwin 243
Locomotives, ten-wheeled 307
Loomis, Elias *146
Looms and cards, woolen 22
Lumber center, a great *111
Lumber machinery 200
Lumber raft, ocean 385
Lumbering enterprise, new 216
Lung troubles, relief for 101

M

Machinery, labor-saving 309
Machine tool exhibits 198
Magicienne 36
Magnesium 118
Mahogany, Mexican 167
Maine, cruiser *212
Man, origin of 201
Manometer, tele *63
Map of the Americas *326
Marine conference, international 272
Marriages, consanguineous 6
Matches, parlor (1280) 187
Matches, safety (1284) 189
Material, good, best economy 289
Materials, raw 180
Mathematician, negro 384
Meat-carrying apparatus *275
Mechanic, the coming 390
Mechanical progress 281
Medicine men, Indian 49
Melinite 228
Mendenhall, Prof. T. C. *136
Metals, tensile tests 326
Metric system progress of 71
Mexico, trade of, progress 340
Mica 295
Mincemeat, Virginia 377
Microscope for lantern *115
Microscope objectives 32
Miles, 85 in 88 minutes 116
Milk and its products 24
Milky way, visitors from 305
Mill, planing, building 113
Mills, why some fail 311
Mind, capacity of the 330
Mineralogical notes 86
Mining, coal, Cape Breton 49
Mines of Bolivia 369
Mines, nickel and copper 208
Mines, salt, Retsof *71
Mirror, astronomical *147
Missionary, American 194
Mississippi River, improvements 21
Mitchell, Maria *38
Mixer, Broughton *339
Moon, temp., in sunshine 405
Molecular actions *360
Moles, removal of 370
Monument, Indiana 227
Monuments, Egyptian, ancient 67
Morphia fiends 65
Mortgage, machinery, etc 136
Mosaic work, Florentine 388
Mosquitoes, to expel 149
Mosquitoes, getting rid of 136
Moth, flour 392
Motor, best form of 6
Motor, steam, Straub's *22
Motor, water, Besemer's *258
Mould, brick, Paul's *384
Mount Stephen *215
Movement, mechanical *34
Movements, rapidity of 407
Mt. Hood, views on *86
Mucilage bottle, new *6
Museum, Boulak 105
Music, evolution of 197
Music leaf turner *179
Music, registering by phonog *230
Mussel poisoning 145

N

Nampa image *393
Natural history notes 56, 102, 201, 296, 312
Naval and marine requirements 373
Naval notes 384
Navigation, steam ocean 112
Navy, British, contract work 313
Navy, condition and needs of 16
Navy, French, types of *199
Navy, new, additions to *19
Navy, our new 25
Navy, Russian, activity 225
Navy yard, New York 180, 256
Nebulæ, discoveries in *54
Necktie, improved *51
Needham, Elias Parkman *404
Negatives, grained, for etching 36
Negatives, yellow stains in 7
Newspaper, great, building 240
Newspapers, American 24
New York, life in 179
Nickel and its alloys 404
Nickel mines, Sudbury 208
Niter, deposits of 371
Nitrate of soda, Chilean *407
Nitrates in rain water 64
Non-conductor, fire proof 104
Notes 296, 401
Norumbega 340
Norwegians in Massachusetts 340

O

Oak leaves, shape of 384
Oats, good, how to tell 280
Objectives, microscope 32
Objects, natural, preservation 373
Obelisk, Central Park 401
Ocean trip, shortening 352
Okonite Co., medal 245
Oil, can, Rau's *163
Oil cloth, sticking together 353
Oil well, the original 309
Oiler, spring cover *5
Opal 56
Opossum orchard, Georgia 183
Ore, iron, Pilot Knob 119
Ore separator, Thomas' *35
Organ, a great 88
Organ, pallet, Girardin's *339
Overstrain, mental and musical 88
Oyster pail, new *20

P

Packing, piston rod *114
Paddle wheel, improved *243
Pail, oyster, new *20
Paint, flexible 277
Paint, how to remove 306
Paint, removing 80
Paintings, water color, fading 401
Palace of food products *102
Palms, uses of 56
Paper, peat 308
Paper, porcelain surface for 216
Paper, wall, protector for *72
Paris exhibition 3, 17, 40, 52, *67, *68, 69, *83, 97, *102, 113, *127, *158, *169, *182, 193, 227, 241, *262, 277, *279, 325, 328, *376
Pasteur's method, criticism of 105
Pasteur's remedy for rabies 102
Pasteur's system, success 120
Patent bought by English 50
Patent, cases important 101
Patent, incandescent lamp 240
Patent office examiners 355
Patent office report 198
Patents 120
Patents, Edison's 165
Patents in Great Britian 48
Peanuts 73
Penholder, Egan's *179
Pendant, watch case *307
Periodicals, value of 197
Peru, damage by water in 209
Peters, Norris 146
Pheasant, Mongolian 273
Philadelphia, cruiser *85, *104
Phonograph 200 years ago 229
Phonograph, improved 224
Phonograph, listening to *331
Phonograph not yet ready 306
Phonograph and photograph 183
Phonograph, possibilities of 305
Phonograph and the press 166
Phosphorus 138
Photographic convention 104
Photographic notes 7, 155, 216, 353
Photographing on linen 216
Photography, amateur 133
Photography, feat in *372
Photography, new use 21
Phthisis, carbonic acid in 226
Physician, practical 17
Pietra dura, Florentine *388
Pipe bending machine *120
Pipe, empty, smoking *72
Pipe, exhaust, locomotive *291
Pipes, hose, notes on 53
Pipes, iron, rusting of 52, 137
Piston rod packing *114
Pitchers of Sarracenia 312
Planchen, widow of, reward 200
Planets, position in August 49
Planets, position of for September 129
Planets, position of for October 192
Planets, position for November 257
Planets, position for December 337
Plant hairs, structure of 201
Plant, sensitive 312
Plants, dulcifying properties 201
Planter, seed, new *67
Planter, Tragethon's *242
Plants, protection of 201
Plate, armor 404
Pleiades, chart of *55
Plow, snow, rotary 404
Plows, steam 200
Pneumatic tube, Johnson *239
Pneumatic conveyer *258
Pneumonia, treatment 180
Poisoning, mussel 145
Polariscope, lantern *145
Pond, Haw, phenom. of 20
Porpoise 169
Portraits, wax, Egyptian 81
Possum orchard, Georgia 183
Post office service, improved 52
Postal facilities, extension 242
Powder and arms, new 116
Powder, noiseless and smokeless 400
Powder, smokeless, wanted 353
Power, horse, origin of 313
Power, water, high pressure 280
Power, water and steam, cost 276
Press, baling *67
Price indicator for scales *211
Price list, novel form 309
Printing leaves 308
Printing machine, improved *214
Printing, photo., hints on 328
Prints, albumen, blisters in 165
Prints, gelatino-bromide, toning 121
Prints, reducing 353
Prints, washing 353
Problems, one of Herschel's 290
Projectiles, photographing *372
Projectiles, remarkable 280
Propeller shaft bearing *82
Propulsion, electric *51
Protector for wall paper *72
Protractor, Duffield's *84
Prussian blue transparencies 128
Pudding science 232
Pump operated by waves 180
Pyrocatechine developer 165

R

Rabbit drive, California *296
Rabbit grub 138, 181
Rabies, Pasteur's remedy for 102
Racing Atlantic 230
Radiators, foot rest for *18
Raft, lumber, ocean 355
Railroad construction in 1889 260
Railroad dog 320
Railroad fire, singular 178
Railroad, Guatemala, sale of 328
Railroad, Housatonic, accident *24
Railroad, Long Island, shops 183
Railroad statistics 147
Railroads, city, power for 39
Railroads of United States 243
Rails, manufacture of *99
Railway, Andean 23
Railway car, Treanor's *195
Railway, Chinese, new 33
Railway, electric, mountain 22
Railway, elevated, wages on 264
Railway, hydraulic 117, 248
Railway, London and N. Western 240
Railway master mechanics 116
Railway, Mount Pilatus *319
Railway, second, veteran of 149
Railway shop notes 148
Railway, ship, new design 305
Railway, sliding, Girard's *337
Railway speed, high 116
Railway from St. Petersburg 86
Railway, transandine 218
Railways, electric 194
Railways, elevated, New York 8
Railways increase trade 354
Railways, street 85
Rain water, nitrates in 64
Raisin industry, California 241
Rattlesnake, double fanged 7, 57, 138
Razor strap, Ray's *323
Refrigerator, Hill's *307
Reliefs, photo., decorative 292
Republic of Brazil 336
Reservoir, gigantic 293
Reservoir, Sodom *103
Reservoir, New York, new 97
Respiragraph, Tata's *131
Resistance, column *163
Resistance, measurement *249
Retort, sharp, an English 36
Rheostat, column *163
Rheumatism, acute, theory of 263
Rheumatism, eel skin for 181
Rhubarb wine (1368) 219
Ricin 386
Rifle, Remington-Lee *211
Rifle, magazine, Russian 401
Right or left leggedness 309
River, subterranean, French 322
Rolls, large 322
Rome, ancient 87
Roofing tank apparatus *162
Rope transmission 357
Rope, wet, strength of 182
Rule, carpenters' *178
Rum, bay (1020) 37
Rush goods, Chinese 144
Rust of stacks, prevention 32
Rust stains 118
Rutherfurd, Lewis M. *375

S

Saccharin 25, 186, 352
Salt mines, Retsof *71
Sanding device, car *370
Sandpapering machine *322
Sash holder, new *18
Savings the foundation of wealth 232
Saw, drag, improved *290
Sawdust 197
Sawing machine, De Graff's *290
Scaffold standard *291
Schools, technical, French *83
Sci. Am. pubs., rates 401
Science, daily developments 248
Science, experimental 273
Science, pudding 232
Scientific American, Spanish 308
Scissors attachment *226
Scrap heap, incident from 278
Screen, window *387
Screw driver and wrench *210
Screw driver, Teubner's *387
Screw threading die *323
Sea waves, height of 104
Seasickness, relief of 248
Seattle, burning of 3
Seed drill, Genung's *370
Seed planter, improved *67
Seeds, color of 312
Seeds, pressure of 201
Senses other than ours 244
Separator, ore *35
Settlement, Norwegian, Mass 340
Sewage disposal problem 161
Sewage purif., amines proc 145
Sewage schemes 323
Sewage treatment 261
Seychelles Islands 200, *217
Sewing machine *6
Seymour, Fred. J. 48, 116
Sharks in Adriatic 201
Shield for firemen *307
Ship, air, Campbell *47
Ship builders, home for 257
Ship canal, Manchester *287
Ship of war Blake 388
Ship railway, new design for 305
Ship, torpedo, countermining 135
Ship, war, new type 257
Ship, war, sunken 308
Ships, loading, Buffalo 264
Ships, passenger, Atlantic *359
Ships, war, electricity on 9
Ships of war, great 128
Ships of war, obsolete 119
Shirts, cuffs, and collars 129
Shoe contract system 246
Shoe heel *307
Shoemaking, essay on 87
Shutter operator, Jorres' *213
Siberia, heat of 86
Sick room, ice in 179
Sick room, light in 145
Sieve for thrashing machine *5
Sifter, ash, Crosby's *210
Sifter, ash, Love's *82, *147
Signal, new, trial of 243
Signal service station, New York *271
Signals, intercepting 7
Signal, railway, electric *402
Silk, artificial 101
Sill plate for cars *194
Silver for 1888 88
Siphon, Meyer's *131
Sleds, propelling *132
Smell, sense of, in horse 69
Smoke consumer, Force's *116
Smoke nuisance 281
Snake bites, best remedy 198
Snake, hoop 309, 344
Snake, horn, myth 114
Snake, joint 2
Soap, blue 307
Soapstone 264
Solder, tenacious 227
Sorghum sugar 53
Sound, transmis. in water 357
South, progress in the 285
Spark conductor, Brandt's *82
Spectacle lenses 201
Spectroscope without lens 295
Sphinx, mountain 406
Spider, poisonous *217
Spider, red 24
Spider web making *130
Spiders, immense 89
Spiders, maternal instinct *23
Spindle wharve *242
Spokane, the lesson of 134
Springs, carriage 228
Squadron, British, speed trials 96
Stacks, smoke, rusting of 32
Stain, cherry (1254) 154
Stains, ink and rust 118
Stair climber, Amiot's *386
Stamp mill, Krause's *323
Stanley, H. M. *391
Stanley, latest discoveries of 336
Stanley, record of 369
Star, history of a 356
Stars and sun, motion of 132
Starboard the helm, term 357
Starch, cassava 7
States, American, congress 225
Statue, Leverrier's *100
Steam carriage 49
Steam engine governor *194
Steam line to Europe 48
Steam navigation, ocean 112
Steam pipes, loss of heat 41
Steam plows 200
Steamboat, the first 120
Steam boiler, Davidson's *178
Steamer Charleston, trial 199
Steamer City of Paris 388
Steamer lines, English 114
Steamer, great 89
Steamer, the oldest 135
Steamer Teutonic *117
Steamer, thirty-five knot 401
Steel, use of nickel with 404
Steel works, great 263
Stirrup, safety *132
Stone drill, Ingersoll *39
Stone moving, Buenos Ayres *360
Stones, precious, artificial 321
Stones, rolling, Nevada 360
Storm apron *194
Storm, the great 177
Stove polish (965) 10
Stove trade 70
Straw vs. twine 354
Streams, running, utilization 97
Streets, London 344
Subway explosions 360
Succeed, how to 41
Success, how to gain 198
Success, methods of 280
Sugar, beet, California 229, 309
Sugar, beet, progress 169
Sugar in boiler incrustation 165
Sugar industries, American 53, 137
Sulphur, recovery of 371
Sun dials, portable 197
Sun, eclipse of 216
Sunfish, fecundity of 307
Sun and stars, motion of 132
Swift, W. F. 17
Swing, child's, McCord's *5
Switch lock, railway *163
Switch, railroad, Wolfe's *258
Synchronism, visual in teleg. *309, 405

T

Tachyscope, electric *393
Tailors, English and American 119
Tallow, bleaching 182
Taylor, William 17
Teachers, shiplead of 89
Teachers, training of 117
Technischer Verein 311
Teeth, filling *98
Teeth, care of 408
Telegraphy, discoverer of 356
Telegraphy, rapid, new sys *309, 405
Telemeter system *63
Telephone Association 224
Telephone exchange plants 34
Telephone, a simple *374
Telephone tickets 18
Telephone, Zigang 132
Telephones in Austria 276
Telephones, French, seizure 209
Telescope, photographic, great 71
Tempering bath, great 241
Tension, low, more copper 309
Teutonic, steamer 38, *117
Textiles, incombustible 165
Thermometer, clinical *4
Thermometer, metallic *340
Thermometer, tele *68
Thermostat *340
Thill coupling, Barr's *291
Thill coupling jack *114
Thill coupling, Lee's *5
Things to know, good 5
Throat, sore, canal 225
Thunderbolt, sarcastic 81
Ticket case, Hart's *370
Tie, rail, Jones' *402
Tiger, saber toothed *390
Tigress, man-eating 151
Tile ditcher *118
Timber in mines, consumption 265
Time across the ocean 245
Time, indication of 245
Time, new notation of 152
Titanium oxide, need for 7
Tomatoes 341
Tombs, ancient, Naples 20
Toning gelatino-bromide prints 121
Toning solution (1028) 43
Tool holder, grindstone *18
Tool, pneumatic, MacCoy *134
Toronto, scientific meeting at 160
Torpedo boat designing 32
Torpedo boats, hot decks in 102
Torpedo boats, new 178
Torpedo, Halpin-Savage *223
Torpedo ship, countermining 135
Torpedo, Sims-Edison *21
Tower American, 1,492 feet 224
Tower on Eagle Rock 134
Tower, Eiffel *166, 178
Tower, Eiffel, first gallery *183
Tower, Eiffel, meteorology 32
Tower, Eiffel, struck by lightning 194
Tower, Eiffel, visit to 149
Traction increaser 177
Trade, foreign, how to extend 243
Trade, increase by railways 354
Trade mark decisions 2, 291
Trade marks in Great Britain 48
Trade, South American 353
Transmission, rope 357
Transparencies, albumen 161
Transparencies, Prussian blue 128
Travel, aerial, secret of 131
Treasures of the deep 244
Tree killing composition 7
Trees, felling, device for *387
Trees, how to kill 57
Trip, ocean, shortening 352
Trip, quick, from Japan 117
Tripod, sketching *236
Trout culture 119
Tube, glass, to bend *50
Tube, pneumatic *239
Tubes, pneum., B. Ayres 245
Tubing, metallic, flexible 149
Tuna, Mexican 161
Tunnel, Harlem River 165
Tunnel, Hudson River *143
Turkey, products of 401
Twins in hen's egg 5
Type writer, Victor *197
Type writers, attachment for *339
Type writers, ink for 293
Typhoid 185
Typhoid, prevention of 215

U

Umbrella stand, Haight's *98
United States, progress of 186
University, Clark 229
Uranium 243
Uranium in Cornwall 401
Useful, if true 114
Utah hotter than Siberia 101

V

Vacuum apparatus, mouth *264
Valve head, Moore's *178
Valve for steam engines *50
Varnish for harness 312
Varnish, negative, black 7
Vari in Berlin Garden *9
Vegetables, medicinal properties 98
Vehicle, two-wheeled *179
Vehicles, draught of 305
Velocipedists, military *243
Ventilator, window *147
Vermin, removal from plants 275
Vertebrates, origin of 201
Vibration in buildings 313
Vibrations, stopping 373
Vine and olive in Algeria 212
Vinegar, toilet (1172) 107
Violin tail piece *338
Viper bite, treatment of 248
Volcanic erupt. in Turkey 214

W

Wages, continental 167
Wages, inventions and 231
Wall paper protector *72
War dances, Indian 49
War ship Blake 388
War ship, new type 257
War ship, sunken, discovery 308
War ships, great 128
War ships, obsolete, more 119
Warnerke's process 246
Washboard protector *291
Washing machine, Johnson's *34
Wasp, spider-hunting 161
Watch case pendant *307
Water, damage by, in Peru 209
Water, Florida (1011) 27
Water, how and when to drink 105
Water, ice, is it healthy? 65
Water, inexpansibility of *4
Water, large head of 18
Water motor, Besemer's *258
Water power, high pressure 280
Water, rain, nitrates in 64
Water, refuse, purification 228
Water for San Francisco 287
Water spout, close view of 308
Water supply of New York 2, 64, 76, 97
Water supply, New York, purity 305
Water wheel, Adams' *213
Water works, Chicago *367
Wave power, utilizing *191
Waves, great, height of 104
Waves, sea, height of 401
Wax figures, how made 404
Wax portraits, Egyptian 80
Wealth, foundation of 232
Weapon, a terrible 144
Weed cutter, railway 148
Welding, electric 329
Well, gas, a deep 255
Wells, artesian, Iowa 19, 197
Wells, artesian, Memphis 116
Wells, oil, temperature 392
Whale, cable broken by 368
Whale, weight of the 201
Whales becoming plentiful 296
Wharve, spindle *242
Wheel, gear, worn *22
Wheel, paddle, improved *242
Wheel, water, Adams' *213
Wheels, car, boring 342
Why it is 185
Wills, some curious 353
Wind pressure 39
Window sash, swinging *226
Window screen, Graves' *387
Window ventilator *147
Windows, dark room 216
Wine, rhubarb (1352) 219
Wines, coloring matters in 5
Wire screw machine *6
Wood carvings, imitation 35
Woodcock, the *198
Wood, polishing 274
Wood working machinery 97
Wood raising in the U. S. 275
Woolen looms and cards 22
Workingmen, American, in Paris 65
Workmen, American 216
World newspaper building 240
Worsteds and woolens 2

Y

Yorktown, cruiser 386

THE Scientific American

ESTABLISHED 1846.

The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete List of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada or Mexico, on receipt of three dollars by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies 10 cents. Address and remit by postal order, express money order, or check.

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid **Magazine of Architecture**, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

7617 6